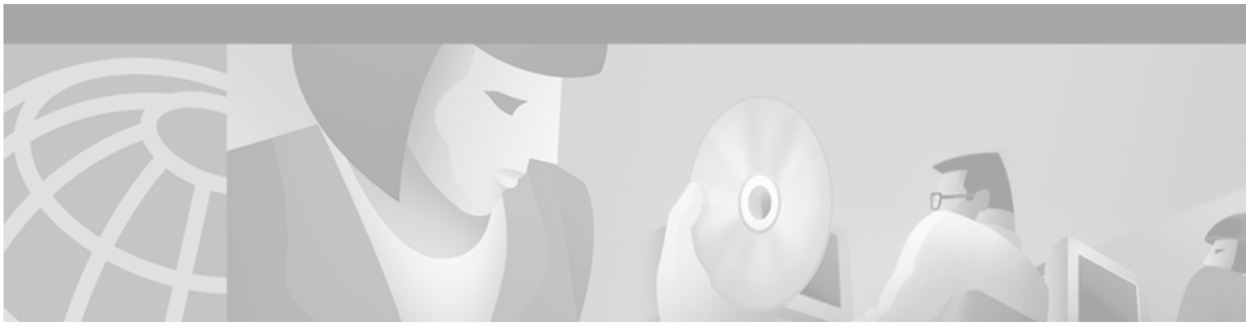


Catalyst 6000 Family Content Switching Module Installation and Configuration Note

Product Number: WS-X6066-SLB-APC

This publication contains the procedures for installing and configuring the Catalyst 6000 family Content Switching Module (CSM).

This publication does not contain the instructions to install the Catalyst 6000 family switch chassis. For information on installing the switch chassis, refer to the *Catalyst 6000 Family Installation Guide*.

Note For translations of the warnings in this publication, see the "Translated Safety Warnings" section on page 54.

Contents

This publication consists of these sections:

CISCO SYSTEMS

Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Overview

The CSM provides high-performance connections between network devices and server farms (groups of real servers) based on Layer 4 through 7 packet information. Clients connect to the CSM by supplying the virtual IP address (VIP) of the virtual server. The CSM is configured to handle VIP address connections. When a client initiates a connection to the virtual server, the CSM chooses a real server (a physical device that is assigned to a server farm) for the connection based on configured load-balancing algorithms and policies.

Representing server farms as virtual servers facilitates scalability and availability. The addition of new servers and the removal or failure of existing servers can occur at any time without affecting the virtual server's availability.

Sticky connections limit traffic to individual servers. These connections are configured so that multiple connections from the same client are stuck to the same real server using source IP addresses, source IP subnets, cookies, secure socket layer (SSL), or redirected using the Hypertext Transfer Protocol (HTTP) requests. Policies manage traffic by defining where to send client requests for information Configuring server load balancing requires that you know the following:

- Network topology you are using in your installation.
- Real server IP addresses.
- The Domain Name Server (DNS) must have an entry for the CSM VIPs (if you want them to be reached through names).
- Each virtual server's IP address.

Note You cannot run Cisco IOS server load balancing software on the same switch as the CSM.

Note The CSM runs on Cisco IOS Release 12.1(6)E or later. If you are using a Supervisor Engine 2, you must use Cisco IOS Release 12.1(8a)E or later. For more information, see the "System Requirements" section on page 9.

Caution You can use the Multilayer Switch Feature Card (MSFC), internal to the Catalyst 6000 family switch, to route traffic on either the client side or the server side of the CSM, but not both simultaneously.

Caution The WS-X6066-SLB-APC Content Switching Module is not fabric enabled.

These sections describe the CSM:

- Features, page 3
- Front Panel Description, page 4
- Operation Mode, page 5
- Client-to-CSM-to-Server Traffic Flow, page 7

Features

Table 1 describes the features of the CSM.

Table 1 Content Switching Module Features

Feature	Description
Management	Standard Cisco IOS command-line interface Management interface integrated with host platform
Load-Balancing Algorithms	Weighted round-robin Weighted least connections Connection high/low watermarks Source address-based hashing algorithm
Flow and URL Identification	URL regular expression match Cookie regular expression match SSL[1] session ID match Source IP address Standard ACLs
Security	Source IP address and URL expression match and AC entry match
Statistics	Packets through normal and special switching Connections created, established, destroyed, current, and timed out Failed server connections Layer 4 load-balanced decisions and rejected connections Layer 7 load-balanced decisions and rejected connections Layer 4 and Layer 7 rejected connections Checksum failures Redirect and FTP connections MAC frames

Table 1 Content Switching Module Features (continued)

Feature	Description
Health Monitoring	TCP, HTTP, ICMP, Telnet, FTP
Other Features	SSL session ID, cookie and source IP address-based sticky connections Fragmented IP frames support MTU[2] of 9000 Load and availability reporting supporting remote monitoring and management High availability preventing service disruptions Redundant modules configured for fault-tolerance support

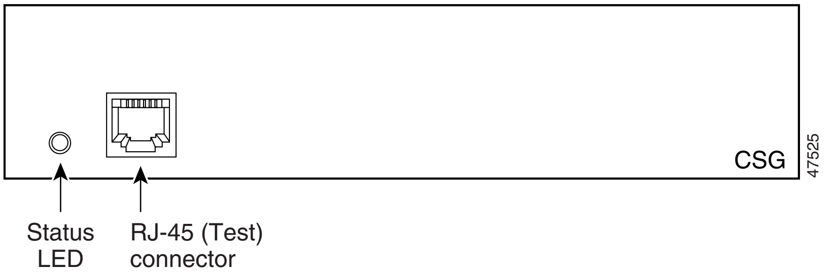
[1] SSL = Secure Socket Layer

[2] MTU = Maximum Transmission Unit

Front Panel Description

The CSM front panel features are shown in Figure 1.

Figure 1 Content Switching Module Front Panel



Note The RJ-45 connector is covered by a removable plate.

Status LED

When the CSM powers up, it initializes various hardware components and communicates with the supervisor engine. The Status LED on the CSM shows the dialog with the supervisor engine and the results of the initialization.

Note For more information on the supervisor engine LEDs, refer to the *Catalyst 6000 Family Module Installation Guide*.

During the normal initialization sequence, the status LED changes from Off to Red, Orange, and then Green. Table 2 describes the status LED operation.

Table 2 Content Switching Module Status LED

Color	Description
Off	• The module is waiting for the supervisor engine to grant power. • The module is not online. • The module is not receiving power, which could be caused by the following: – Power is not available to the CSM. – Module temperature is over the limit[1].
Red	• The module is released from reset by the supervisor engine and is booting. • If the boot code fails to execute, the LED stays red after power up.
Orange	• The module is initializing hardware or communicating with the supervisor engine. • A fault occurred during the initialization sequence. • If the module fails to download its Field Programmable Gate Arrays (FPGAs) on power up, it still proceeds with the rest of the initialization sequence and is granted module online status from the supervisor engine, but the LED stays orange. • If the module is not granted module online status from the supervisor engine, the LED stays orange. This problem could be caused by the supervisor engine detecting a failure in an external loopback test that it issued to the CSM.
Green	• The module is operational; the supervisor engine has granted module online status.
Green to Orange	• The module is disabled through the supervisor engine CLI [2] using the **set module disable** *mod* command.

[1] Enter the **show environment temperature** *mod* command to display the temperature of each of four sensors on the CSM.

[2] CLI = command-line interface.

RJ-45 Connector

The RJ-45 connector on the front panel provides a connection point for a management station or test device. The RJ-45 connector is covered by a removable plate. Typically, this connector is used by field engineers to perform testing and to obtain dump information.

Operation Mode

Clients and servers communicate through the CSM using Layer 2 and Layer 3 technology in a specific VLAN configuration. (See Figure 2.) Clients connect to the client side VLAN and servers connect to the server side VLAN. Servers and clients can exist on different subnets. Servers can also be located one or more Layer 3 hops away and connect to the server-side VLAN through routers.

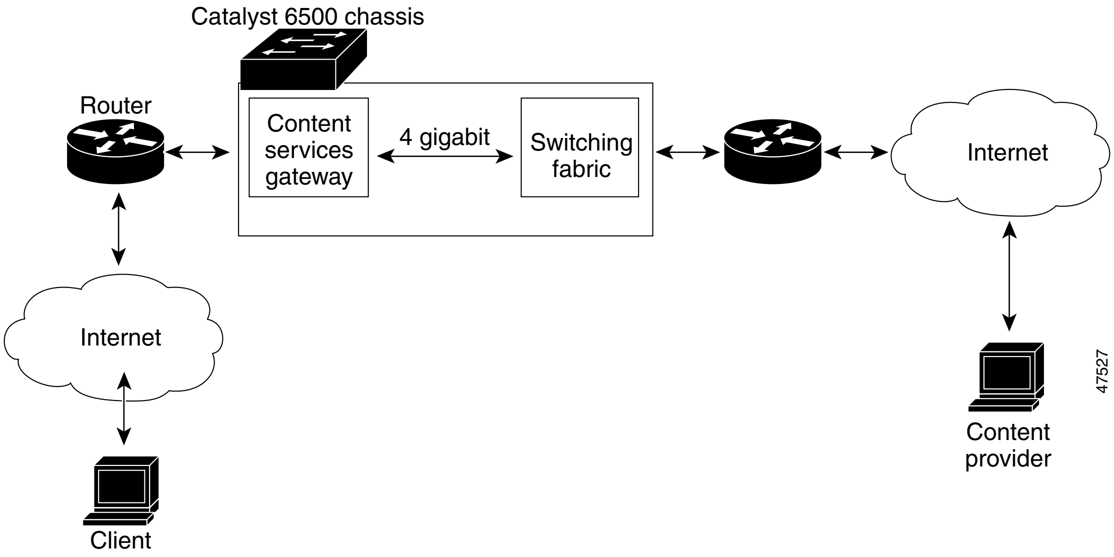
A client sends a request that arrives on one of the module’s VIP addresses. The CSM forwards this request to a server that can satisfy the request. The server then forwards the response to the CSM. The CSM forwards the response to the client.

When the client-side and server-side VLANs are on the same subnets, you can configure the CSM in single subnet (bridge) mode. For more information, see the "Single Subnet (Bridge) Mode Configuration" section on page 35.

When the client- and server-side VLANs are on different subnets, you can configure the CSM to operate in a secure (router) mode. For more information, see the "Secure (Router) Mode Configuration" section on page 37.

You can set up a fault-tolerant configuration in either the secure (router) or single subnet (bridged) mode using redundant CSMs. For more information, see the "Fault-Tolerant Configuration" section on page 38. Using multiple VLANs, single subnet (bridge) mode and secure (router) mode can coexist in the same CSM.

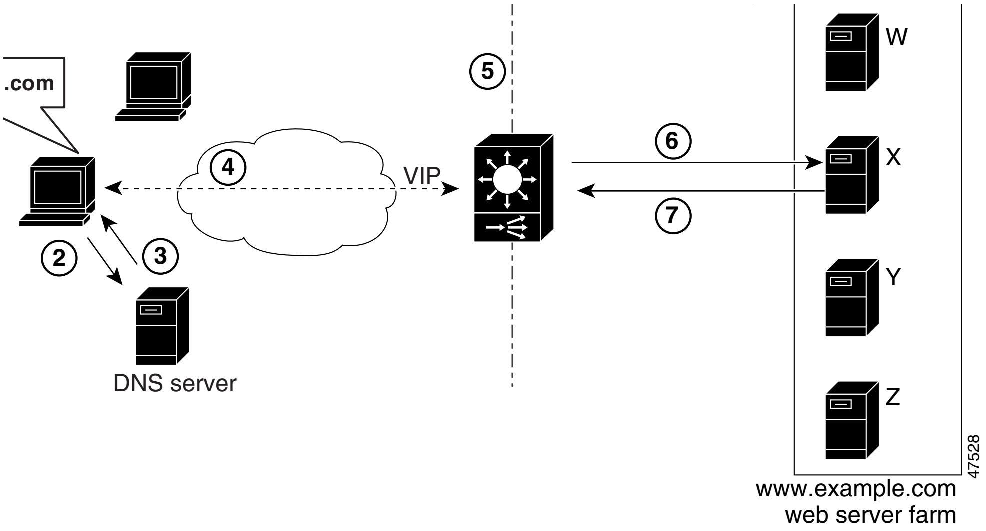
Figure 2 Content Switching Module and Servers



Client-to-CSM-to-Server Traffic Flow

This section describes how the traffic flows between the client and server in a CSM environment. (See Figure 3.)

Figure 3 Client-to-Content Switching Module-to-Server Traffic Flow



Note The numbers in Figure 3 refer to the steps in the following procedure.

When you enter a request for information by entering a URL, the traffic flow is as follows:

Step 1 You enter a URL. (For example, in Figure 3 you enter www.fox.com.)

Step 2 The client contacts a DNS server to locate the IP address associated with the URL you entered.

Step 3 The DNS server sends the IP address of the virtual IP (VIP) to the client.

Step 4 The client uses that IP address (CSM VIP) to send the HTTP request to the CSM.

Step 5 The CSM receives the request with the URL, makes a load balancing decision, and selects a server. For example, in Figure 3, the CSM selects a server (X server) from the www.fox.com server pool, replacing its own VIP address with the address of the X server and forwards the traffic to the X server.

Step 6 The CSM performs the Network Address Translation (NAT).

Safety Overview

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, may harm you. A warning symbol precedes each warning statement.

Warning **This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the "Translated Safety Warnings" section in this document.**

Waarschuwing **Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het gedeelte "Translated Safety Warnings" (Vertalingen van veiligheidsvoorschriften) raadplegen in dit document.**

Varoitus **Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät tämän asiakirjan "Translated Safety Warnings" (käännetyt turvallisuutta koskevat varoitukset).**

Attention **Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez la section « Translated Safety Warnings » (Traduction des avis de sécurité) de ce document.**

Warnung **Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Abschnitt "Translated Safety Warnings" (Übersetzung der Warnhinweise) in diesem Dokument.**

Avvertenza **Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nella documento "Translated Safety Warnings" (Traduzione delle avvertenze di sicurezza) nel presente documento.**

Advarsel **Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i avsnittet "Translated Safety Warnings" [Oversatte sikkerhetsadvarsler] i dette dokumentet.**

Aviso **Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Para ver as traduções dos avisos que constam desta publicação, consulte a secção "Translated Safety Warnings" - "Traduções dos Avisos de Segurança" neste documento.**

¡Advertencia! **Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Para ver una traducción de las advertencias que aparecen en esta publicación, consultar la sección titulada "Translated Safety Warnings" que aparece en este documento.**

Varning! **Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador. Om du vill se översättningar av de varningar som visas i denna publikation, se avsnittet "Translated Safety Warnings" [Översatta säkerhetsvarningar] i detta dokument.**

Warning **Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.**

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.**

System Requirements

Before you install the CSM into the Catalyst 6000 family switch, make sure your Catalyst 6000 family switch meets the hardware and software requirements listed in this section.

Caution You cannot run Cisco IOS server load-balancing software on the same switch as the CSM.

Caution You can use the MSFC, internal to the Catalyst 6000 family switch, to route traffic on either the client side or the server side of the CSM, but not both simultaneously.

Memory Requirements

The CSM memory is not configurable.

Hardware Supported

Before you can use the CSM, you must have a Supervisor Engine 1A with an MSFC and a Policy Feature Card (PFC), or a Supervisor Engine 2 with an MSFC, and any module with ports to connect server and client networks. The PFC is required for the VLAN access control list (VACL) capture functionality.

Caution The WS-X6066-SLB-APC Content Switching Module is not fabric enabled.

Product Number	Product Description	Minimum Software Version	Recommended Software Version	IOS Release
Content Switching Module				
WS-X6066-SLB-APC with Supervisor Engine 1A	Content Switching Module	1.1(1)	1.1(1) or higher	12.1(6)E or 12.1(7)E
WS-X6066-SLB-APC with Supervisor Engine 1A	Content Switching Module	1.1(1)	1.2(1) or higher	12.1(8)E
WS-X6066-SLB-APC with Supervisor Engine 2	Content Switching Module	1.2(1)	1.2(1)	12.1(8a)E
Console Cable				
72-876-01	Console Cable	Not applicable	Not applicable	Not applicable
Accessory Kit				
800-05097-01	Accessory kit (contains the Console Cable)	Not applicable	Not applicable	Not applicable

Environmental Requirements

The CSM operates in temperatures from 0° to 40° C (32° to 104° F). The module can withstand, without damage, nonoperating temperatures from –40° to 70° C (–40° to 158° F).

The CSM can operate in relative humidity from 10 to 90 percent (noncondensing) and can withstand, without damage, nonoperating relative humidity of 5 to 95 percent (noncondensing).

Power Requirements

You can place the CSM in any slot in the Catalyst 6000 family chassis except for the slots occupied by the supervisor engine and the standby supervisor engine. The CSM operates on power supplied by the chassis.

Note Slot 1 is reserved for the supervisor engine. Slot 2 can contain an additional supervisor engine in case the supervisor engine in slot 1 fails. If a redundant supervisor engine is not required, you can insert the CSM in slots 2 through 6 on the 6-slot chassis, in slots 2 through 9 on a 9-slot chassis, or slots 2 through 13 on the 13-slot chassis.

Software Requirements

Catalyst 6000 family CSM software release 1.1(1) requires Cisco IOS Release 12.1(6)E or 12.1(7)E.

Catalyst 6000 family CSM software release 1.2(1) requires Cisco IOS Release 12.1(8a)E or later only.

CSM Software Release	Software Part Number	Hardware	Cisco IOS Release	Added Features
1.1(1)	SC6k-SLB-APC-1.1	Supervisor Engine 1A with MSFC and PFC	12.1(6)E or 12.1(7)E	Initial Release
1.2(1)	SC6K-1.2-CSM	Supervisor Engine 1A with MSFC and PFC	12.1(8a)E	Supervisor Engine 2 support
1.2(1)	SC6K-1.2-CSM	Supervisor Engine 2 Module with MSFC 2	12.1(8a)E	Supervisor Engine 2 support

Required Tools

This section describes the tools and requirements you need to install the CSM.

Note Before installing the CSM, you must install the Catalyst 6000 family switch chassis and at least one supervisor engine. For information on installing the switch chassis, refer to the *Catalyst 6000 Family Installation Guide*.

These tools are required to install the CSM into the Catalyst 6000 family switch:

- Flat-blade screwdriver
- Wrist strap or other grounding device
- Antistatic mat or antistatic foam

Caution Whenever you handle the supervisor engine or switching modules, always use a wrist strap or other grounding device to prevent electrostatic discharge (ESD). See the "Installing the Content Switching Module" section on page 11 for more information.

Installing the Content Switching Module

To install the CSM into the Catalyst 6000 family switch, perform the steps in the following sections:

- Preparing to Install the CSM, page 11
- Installing the CSM, page 12
- Verifying the Installation, page 15

Preparing to Install the CSM

Before installing the CSM, make sure that the following are available:

- Catalyst 6000 family switch chassis
- Servers that are connected to the Catalyst 6000 family switch through a bridged or a routed connection
- Management station that is available through a Telnet or a console connection to perform configuration tasks

Installing the CSM

This section describes how to install the CSM into the Catalyst 6000 family switch.

Note All modules, including the supervisor engine (if you have redundant supervisor engines), support hot swapping. You can add, replace, or remove modules without interrupting the system power or causing other software or interfaces to shut down. For more information about hot-swapping modules, refer to the *Catalyst 6000 Family Module Installation Guide*.

To install the CSM into the Catalyst 6000 family switch, perform these steps:

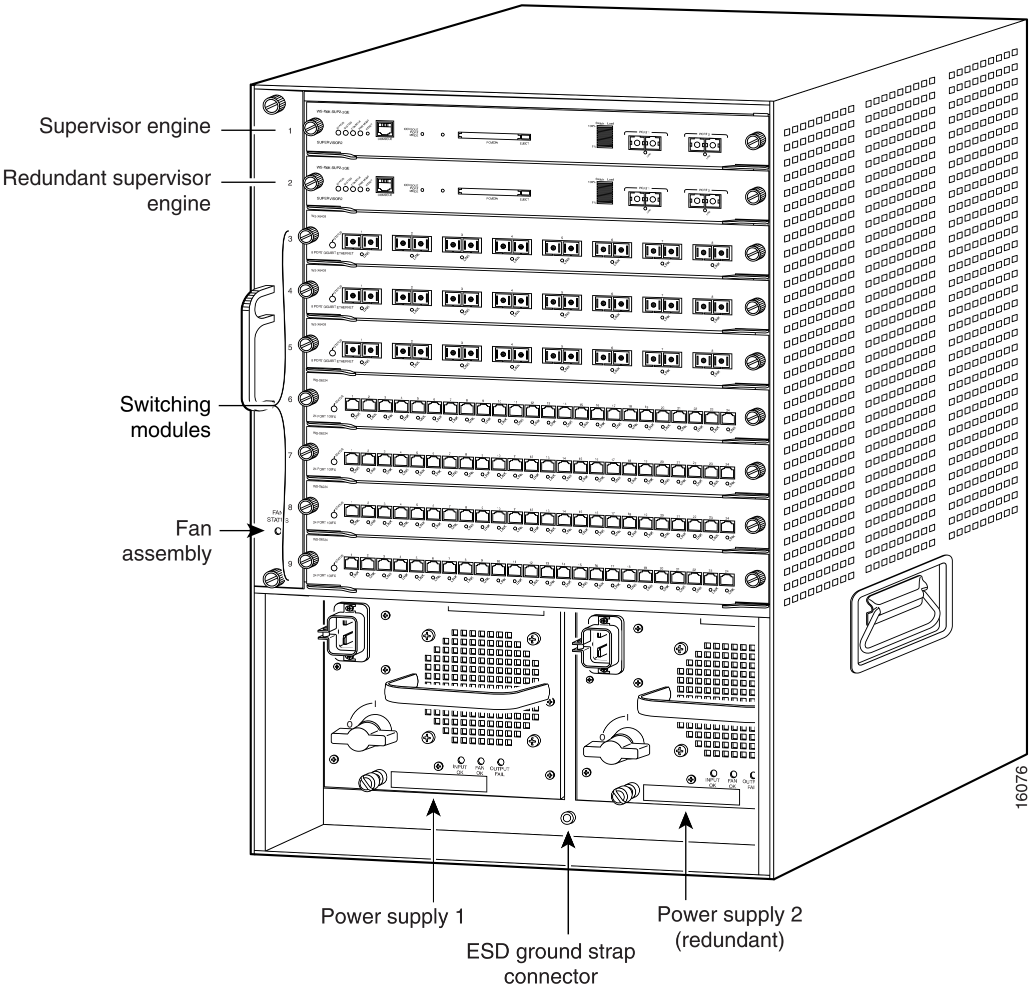
Step 1 Make sure you take the necessary precautions to prevent ESD damage.

Warning **During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.**

Step 2 Choose a slot for the CSM. See Figure 4 for slot numbers on a Catalyst 6000 family switch.

Note Slot 1 is reserved for the supervisor engine. Slot 2 can contain an additional supervisor engine in case the supervisor engine in slot 1 fails. If a redundant supervisor engine is not required, you can insert the CSM in slots 2 through 9 on a 9-slot chassis, or slots 2 through 6 on the 6-slot chassis, or slots 2 through 13 on the 13-slot chassis.

Figure 4 Slot Numbers on Catalyst 6000 Family Switches


Supervisor engine
Redundant supervisor engine
Switching modules
Fan assembly
1
2
3
4
5
6
7
8
9
Power supply 1
ESD ground strap connector
Power supply 2 (redundant)
16076

Step 3 Check that there is enough clearance to accommodate any interface equipment that you will connect directly to the supervisor engine or switching-module ports.

Note If possible, place switching modules between empty slots that contain only switching-module filler plates (Cisco part number 800-00292-01).

Warning **Blank faceplates (filler panels) serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards and faceplates are in place.**

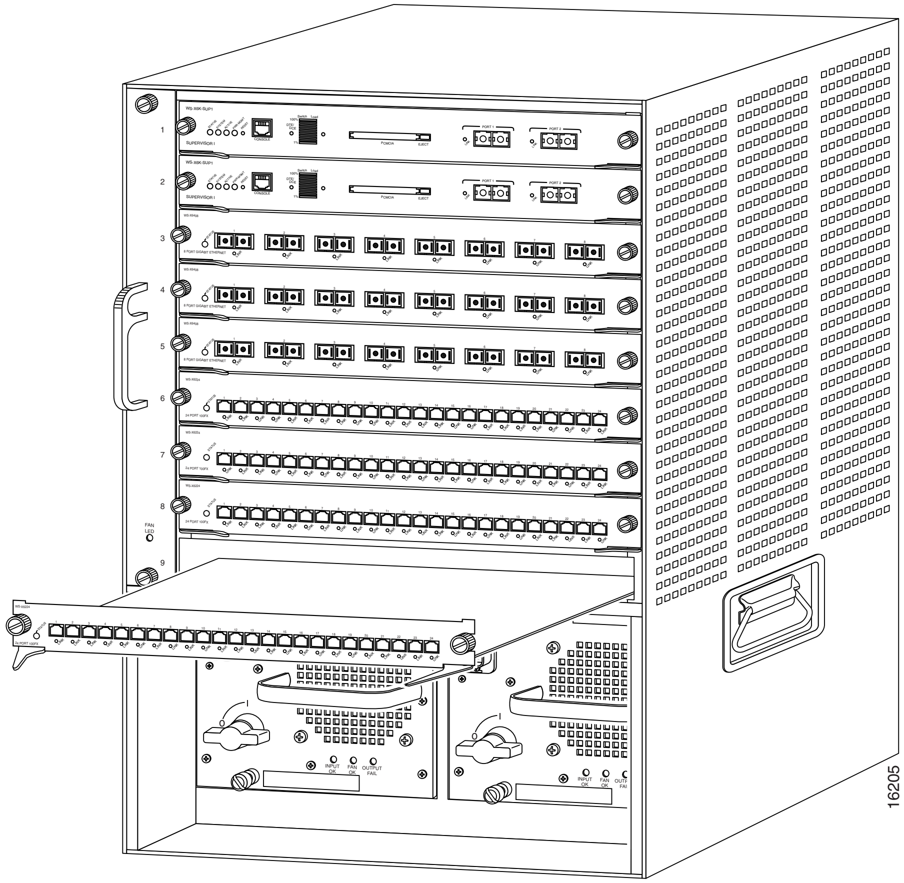
Step 4 Loosen the captive installation screws that secure the switching-module filler plate (or an existing switching module) to the desired slot.

Step 5 Remove the switching-module filler plate (or an existing switching module).

Step 6 Hold the handle of the CSM with one hand, and place your other hand under the carrier support. Do not touch the printed circuit boards or connector pins.

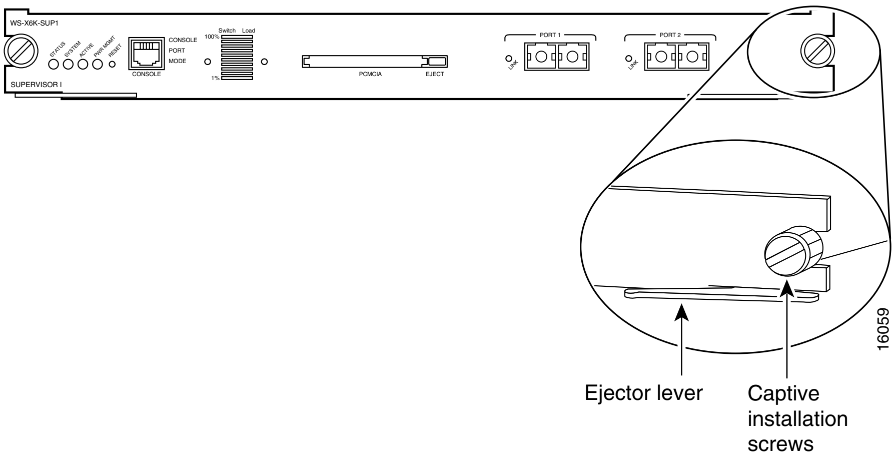
Step 7 Place the CSM in the slot. Align the notch on the sides of the switching-module carrier with the groove in the slot. (See Figure 5.)

Figure 5 Installing Modules in the Catalyst 6000 Family Switch



Step 8 Keep the CSM at a 90-degree orientation to the backplane and carefully slide the CSM into the slot until the switching-module faceplate contacts the ejector levers. (See Figure 6.)

Figure 6 Ejector Levers and Captive Installation Screws



Step 9 Using the thumb and forefinger of each hand, simultaneously push in the left and right levers to fully seat the CSM in the backplane connector.

Caution Always use the ejector levers when installing or removing the CSM. A module that is partially seated in the backplane will cause the system to halt and subsequently crash.

Note If you perform a hot swap, the console displays the message “Module *n* has been inserted.” This message does not appear, however, if you are connected to the Catalyst 6000 family switch through a Telnet session.

Step 10 Use a screwdriver to tighten the captive installation screws on the left and right ends of the CSM.

This completes the CSM installation procedure.

Verifying the Installation

When you install the CSM into the Catalyst 6000 family switch, the module goes through a boot sequence that requires no intervention. At the successful conclusion of the boot sequence, the green status LED will illuminate and remain on.

Using the Command-Line Interface

The software interface for the CSM is the Cisco IOS interface. To understand the Cisco IOS command-line interface and Cisco IOS command modes, refer to Chapter 2 in the *Catalyst 6000 Family IOS Software Configuration Guide*.

Note Because of each prompt's character limit, some prompts may be truncated. For example: Router(config-slb-vlan-server)# may appear as Router(config-slb-vlan-serve)#

Accessing Online Help

In any command mode, you can get a list of available commands by entering a question mark (?) as follows:

```
Router> ?
```

or

```
Router(config)# ip slb ?
```

Note Online help shows the default configuration values and ranges available to commands.

Upgrading to a New Software Release

This section describes the three methods on how to upgrade the CSM:

- Upgrading from the Supervisor Engine Bootflash, page 17
- Upgrading from a PCMCIA Card, page 18
- Upgrading Over the Network, page 18

Note When upgrading to a new software release, you must upgrade the CSM image before upgrading the Cisco IOS image. Failure to do so will cause the supervisor engine to not recognize the CSM. In this case, you would have to downgrade the Cisco IOS image, upgrade the CSM image, and then upgrade the Cisco IOS image.

During the upgrade, enter all commands on a console connected to the supervisor engine. Enter each configuration command on a separate line. To complete the upgrade, enter the **exit** command to return to the supervisor engine prompt.

Caution You must enter the **exit** command to terminate sessions with the CSM being upgraded. If you do not terminate the session and you remove the CSM from the Catalyst 6000 family chassis, you cannot issue configuration commands to the CSM unless you press **Ctrl** + **^**, enter **x**, and type the **disconnect** command at the prompt.

Upgrading from the Supervisor Engine Bootflash

Upgrade the CSM from the supervisor engine bootflash as follows:

Note Refer to the C*atalyst 6000 Family Supervisor Engine Flash PC Card Installation Note* for instructions on loading images into bootflash.

Step 1 Enable the TFTP server to supply the image from bootflash as follows:

```
Router>
Router> enable
Router# conf t
Router(config)# tftp-server sup-bootflash:c6slb-apc.revision-num.bin
Router(config)
```

Step 2 Set up a session between the supervisor engine and the CSM:

```
Router# session CSM-slot-number 0
```

Step 3 Load the image from the supervisor engine to the CSM:

```
CSM> upgrade 127.0.0.zz c6slb-apc.revision-num.bin
```

where

zz = 12 if the supervisor engine is installed in chassis slot 1
zz = 22 if the supervisor engine is installed in chassis slot 2

Note The supervisor engine can only be installed in chassis slot 1 or slot 2.

Step 4 Reboot the CSM by power cycling the CSM or by issuing the following commands on the supervisor engine console.

```
Router# config t
Router(config)# power cycle module slot-number
```

Upgrading from a PCMCIA Card

Upgrade the CSM from a removable Flash (PCMCIA) card inserted in the supervisor engine as follows:

Step 1 Enable the TFTP server to supply the image from the removable Flash card:

```
Router>
Router> enable
Router# conf t
Router(config)# tftp-server slotx:c6slb-apc.revision-num.bin
```

where

x = 0 if the PCMCIA card is installed in supervisor engine PCMCIA slot 0.

Step 2 Set up a session between the supervisor engine and the CSM:

```
Router# session CSM-slot-number 0
```

Step 3 Load the image from the supervisor engine to the CSM:

```
CSM> upgrade slot0: c6slb-apc.revision-num.bin
```

Note The supervisor engine can only be installed in chassis slot 1 or slot 2.

Step 4 Reboot the CSM by power cycling the CSM or by issuing the following commands on the supervisor engine console:

```
router# config t
Router (config)# power cycle module slot-number
```

Upgrading Over the Network

Upgrade the CSM from an external TFTP server as follows:

Step 1 Create a VLAN on the supervisor engine for the TFTP CSM runtime image download.

Note It is possible to use an existing VLAN. However, for reliability in the download, create a VLAN specifically for the TFTP connection.

Step 2 Configure the interface that is connected to your TFTP server.

Step 3 Add the interface to the VLAN.

Step 4 Enter the **ip slb vlan** command, as explained in the "Configuring VLANs" section on page 21, to make the VLAN a client VLAN.

Step 5 Add an IP address to the VLAN for the CSM.

Step 6 Enter the **show** command as described in "Configuring VLANs" section on page 21 to verify the configuration.

Step 7 Make a Telnet connection into the CSM with the **session** *CSM-slot-number* **0** command.

Step 8 Upgrade the image using the **upgrade** *TFTP-server-IP-address* **c6slb-apc.***rev-number***.bin** command.

Configuring the Content Switching Module

This section describes how to configure load balancing on the CSM. Before you configure the CSM, the switch must meet these prerequisites:

Caution Enter the **ip slb mode csm** command before you enter any other CSM configuration commands.

- The Cisco IOS versions for the switch and the module must match.
- Turn off the Cisco IOS-based server load balancing. Enter the **ip slb mode** and enable the CSM operating mode **csm** (content switching mode) which disables the **rp** (router processing mode).

  This example shows how to enable the **csm** mode:

```
Router(config)# ip slb mode ?
    csm SLB in Application Processor Complex board
    rp SLB in IOS system
Router(config)# ip slb mode csm
```

- You must configure VLANs on the Catalyst 6000 family switch before you configure VLANs for the CSM. VLAN IDs must be the same for the switch and the module. Refer to the *Catalyst 6000 Family Software Configuration Guide* for details.

  This example shows how to configure VLANs:

```
Router>
Router> enable
Router# vlan database
Router(vlan)# vlan 130
VLAN 130 added:
    Name: VLAN130
Router(vlan)# vlan 150
VLAN 150 added:
    Name: VLAN150
Router(vlan)# exit
```

- You should place physical interfaces that connect to the servers or to the clients in the corresponding VLAN.

  This example shows how to configure a physical interface as a Layer 2 interface and assign it to a VLAN:

```
Router>
Router> enable
Router# config
Router(config)# interface 3/1
Router(config-if)# switchport
Router(config-if)# switchport access vlan 150
Router(config-if)# no shutdown
Router(vlan)# exit
```

If the Multilayer Switch Function Card (MSFC) is used on the next hop router on either the client or the server side VLAN, then the corresponding Layer 3 VLAN interface must be configured.

Caution The MSFC cannot be used simultaneously as the router for both the client and the server side. Do not configure the Layer 3 VLAN interface for both the client and the server side.

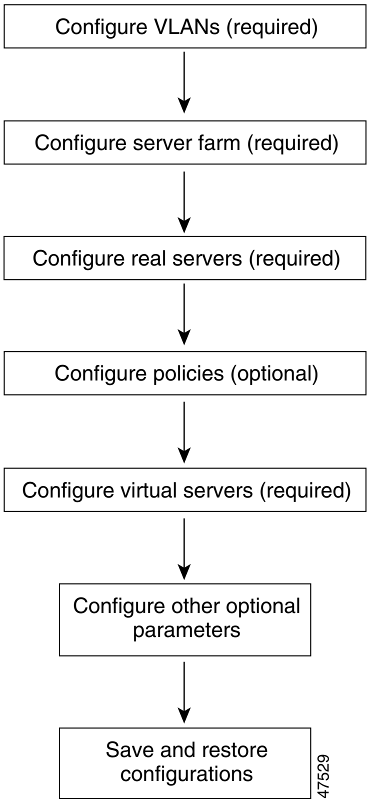
This example shows how to configure the Layer 3 VLAN interface:

```
Router>
Router> enable
Router# config
Router(config)# interface vlan 130
Router(config-if)# ip address 10.10.1.10 255.255.255.0
Router(config-if)# no shutdown
Router(vlan)# exit
```

Figure 7 shows an overview of the configuration process. Required and optional operations are shown.

Note Configuring policies is not necessary for basic Layer 4 load balancing.

Figure 7 Configuration Overview


Configure VLANs (required)
Configure server farm (required)
Configure real servers (required)
Configure policies (optional)
Configure virtual servers (required)
Configure other optional parameters
Save and restore configurations
47529

Configure the required parameters in the following sections:

- Configuring VLANs, page 21
- Configuring Server Farms, page 24
- Configuring Real Servers, page 25
- Configuring Policies, page 26
- Configuring Virtual Servers, page 30

After you configure the required load-balancing parameters on the CSM, you may configure the optional parameters in the following sections:

- Configuring TCP Parameters, page 31
- Configuring Dynamic Feedback Protocol, page 31
- Configuring Redirect Virtual Servers, page 32
- Configuring Client NAT Pools, page 33
- Configuring Server NAT, page 34

To save or restore your configurations or to work with advanced configurations, refer to the following sections:

- Writing and Restoring Configurations, page 34
- Configuration Examples, page 35
- Configuring Probes for Health Monitoring, page 46
- Configuring Route Health Injection, page 51

Configuring VLANs

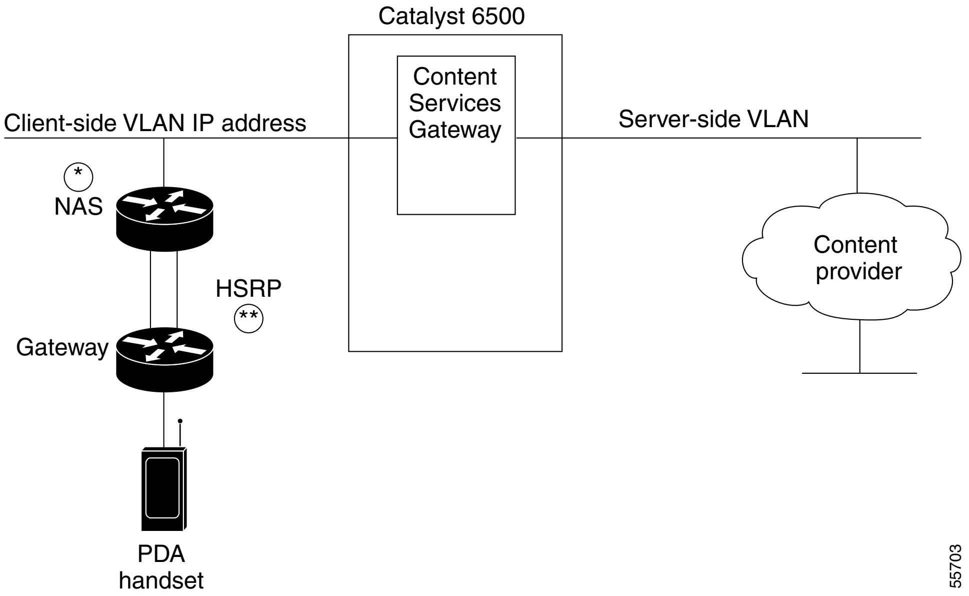
The CSM requires configuration for client-side and server-side VLANs when you install the module in a Catalyst 6500 series switch.

Note You must configure VLANs on the Catalyst 6000 family switch before you configure VLANs for the CSM. VLAN IDs must be the same for the switch and the module.

The CSM dynamically allocates one client gateway to the active router for a total of two client gateways for an HSRP group. You can configure a maximum of three HSRP groups on the client side of the CSM; fewer if other routers exist on the client-side.

You need to create both a client- and server-side VLAN. (See Figure 8.)

Figure 8 Configuring VLANs



See Figure 8 for the following notes:

Note *Any router configured as a client-side gateway or a next hop router for servers more than one hop away must have ICMP redirects disabled. The CSM does not perform a Layer 3 lookup to forward traffic; the CSM cannot act upon ICMP redirects.

Note ** HSRP provides automatic router backup using an active standby router that allows active and standby routers in an HSRP group to exchange messages and respond to topology changes by selecting a new active router dynamically. Because traffic can come from both the virtual and physical MAC addresses of the gateway, the CSM uses two entries per virtual IP gateway configured. You can configure only seven client gateways on the CSM. An HSRP group is assigned one client gateway for the virtual IP address when it is configured. (See the "Configuring HSRP" section on page 43.)

Configuring Client-Side VLANs

To configure client-side VLANs, perform this task:

Caution You cannot use VLAN 1 as a client-side or server-side VLAN for the CSM.

	Command	Purpose
Step 1	Router(config)# **ip slb vlan** *vlanid* **client**	Configure the client-side VLANs and enter the client VLAN mode[1].
Step 2	Router(config-slb-vlan-client)# **ip** *ip-address netmask*	Configure an IP address to the CSM used by probes and ARP requests on this particular VLAN[2].
Step 3	Router(config-slb-vlan-client)# **gateway** *ip-address*	Configure the gateway IP address. Enter this command only in the client submode.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

This example shows how to configure the CSM for client-side VLANs:

```
Router(config)# ip slb vlan 130 client
Router(config-slb-vlan-client)# ip addr 123.44.50.6 255.255.255.0
Router(config-slb-vlan-client)# gateway 123.44.50.1
Router(config-slb-vlan-client)# exit
Router# show ip slb VLAN
```

Configuring Server-Side VLANs

To configure server-side VLANs, perform this task:

	Command	Purpose
Step 1	Router(config)# **ip slb vlan** *vlanid* **server**	Configure the server-side VLANs and enter the server VLAN mode[1].
Step 2	Router(config-slb-vlan-server)# **route** *ip-address netmask* **gateway** *gw-ip-address*	Configure a static route to reach the real servers in case they are more than one Layer 3 hop away from the CSM.
Step 3	Router(config-slb-vlan-server)# **alias** *ip-address netmask*	Optionally, you can configure multiple IP addresses to the CSM to place the module in a different IP network than real servers without using a router. Use this command only in the server submode.
Step 4	Router(config-slb-vlan-server)# **ip** *ip-address netmask*	Configure an IP address for the server VLAN[2].
Step 5	Router # **show ip slb vlan**	Display the client-side and server-side VLAN configurations.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

This example shows how to configure the CSM for server-side VLANs:

```
Router(config)# ip slb vlan 150 server
Router(config-slb-vlan-server)# ip addr 123.46.50.6 255.255.255.0
Router(config-slb-vlan-server)# route 123.50.0.0 255.255.0.0 gateway 123.44.50.1
Router(config-slb-vlan-server)# alias 123.60.7.6 255.255.255.0
Router(config-slb-vlan-server)# exit
```

Configuring Server Farms

A server farm or server pool is a collection of servers that contain the same content. You specify the server farm name when you configure the server farm and add servers to it, and when you bind the server farm to a virtual server. Configuring server farms requires naming the server farm, configuring a load-balancing algorithm (predictor) and other attributes of the farm, setting or specifying a set of real servers (see the "Configuring Real Servers" section on page 25), and setting or specifying the attributes of the real servers.

When you configure server farms, you must perform the following:

- Create the server farm
- Configure the server farm
- Create real servers
- Configure the real servers

To configure server farms, perform this task:

	Command	Purpose
Step 1	Router(config)# **ip slb serverfarm** *serverfarm-name*	Create and name a server farm and enter the server farm configuration mode[1] [2].
Step 2	Router(config-slb-sfarm)# **predictor** [**roundrobin** | **leastconns** | **ip-hash** *netmask*]	Configure the load-balancing prediction algorithm[2]. If not specified, the default is **roundrobin**.
Step 3	Router(config-slb-sfarm)# **nat client** *client-pool-name*	Enable the NAT mode, client[2]. Refer to the "Configuring Client NAT Pools" section on page 33[3].
Step 4	Router(config-slb-sfarm)# **probe** *probe-name*	Associate the server farm to a probe that can be defined by the **probe** command[2, 3].
Step 5	Router(config-slb-sfarm)# **bindid** *bind-id*	Bind a single physical server to multiple server farms and report a different weight for each one[2]. The **bindid** is used by DFP[3].
Step 6	Router# **show ip slb serverfarm** *serverfarm-name* [**detail**]	Display information about one or all server farms.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

[3] This step is optional.

This example shows how to configure a server farm, named p1_nat, using the least-connections (**leastconns**) algorithm. The least-connections algorithm specifies which real server handles the next new connection for this server farm.

```
Router(config)# ip slb serverfarm p1_nat
Router(config-slb-sfarm)# predictor leastconns
```

Configuring Real Servers

Real servers are physical devices assigned to a server farm. Real servers provide the services that are load balanced. When the server receives a client request, it pulls matching information from a disk and sends it to the CSM for forwarding to the client.

You configure the real server in the real server configuration mode by specifying the server IP address and port when you assign it to a server farm. You enter the real server configuration mode from the serverfarm mode where you are adding the real server.

To configure real servers, perform this task:

	Command	Purpose
Step 1	`Router(config-slb-sfarm)# real ip-address [port]`	Identify a real server as a member of the server farm and enter the **real** server configuration mode. An optional translation port can also be configured[1, 2].
Step 2	`Router(config-slb-real)# weight weighting-value`	(Optional) Set the weighting value for the virtual server predictor algorithm to assign the server's workload capacity relative to the other servers in the server farm if the round robin or least connection is selected[2].
Step 3	`Router(config-slb-real)# maxconns max-conns`	(Optional) Set the maximum number of active connections on the real server[2]. When the specified maximum is reached, no more new connections are sent to that real server until the number of active connections drops below the minimum threshold.
Step 4	`Router(config-slb-real)# minconns min-conns`	(Optional) Set the minimum connection threshold[2].
Step 5	`Router(config-slb-real)# inservice`	Enable the real server for use by the CSM[2]. **Note** Repeat Steps 1 through 5 for each real server you are configuring.
Step 6	`Router# show ip slb reals [sfarm serverfarm-name] [detail]`	(Optional) Display information about configured real servers. The **vserver** option limits the display to real servers associated with a particular virtual server. The **detail** option displays detailed real server information.
Step 7	`Router# show ip slb conns [sfarm vserver virtserver-name] [client ip-address] [detail]`	Display active connections to the CSM. The **sfarm** option limits the display to connections associated with a particular server farm. The **client** option limits the display to connections for a particular client. The **detail** option displays detailed connection information.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

This example shows how to create real servers:

```
Router(config)# ip slb serverfarm serverfarm
Router(config-slb-sfarm)# real 10.8.0.7
Router(config-slb-real)# inservice
Router(config-slb-sfarm)# real 10.8.0.8
Router(config-slb-real)# inservice
Router(config-slb-sfarm)# real 10.8.0.9
Router(config-slb-real)# inservice
Router(config-slb-sfarm)# real 10.8.0.10
Router(config-slb-real)# inservice
Router(config-slb-real)# end
Router# show ip slb real detail
Router# show ip slb conns detail
```

Configuring Policies

Policies are access rules that traffic must match when balancing to a server farm. They provide the means for the CSM to balance Layer 7 traffic. Multiple policies can be assigned to one virtual server, creating multiple access rules for that virtual server. When configuring policies, you first specify access rules by URL maps, client-groups, and sticky groups, and then you combine these access rules under a particular policy.

Note You must associate policies with one server farm. A policy that does not have an associated server farm cannot forward traffic. The server farm associated with a policy receives all the requests that match that policy.

When the CSM is able to match policies, it selects the policy that appears first in the policy list. Policies are located in the policy list in the sequence in which they were bound to the virtual server. You can reorder the policies in the list by removing policies and reentering them in the correct order. Enter the **no slb-policy** *policy name* and the **slb-policy** *policy name* commands in the *ip slb vserver* submode to remove and enter policies.

Caution When changing the policies associated with a vserver, you must take out and put back the vserver in service to reflect the changes.

To configure load-balancing policies, perform this task:

	Command	Purpose
Step 1	`Router(config)# ip slb policy policy-name`	Create the policy and enter the policy submode to configure the policy attributes[1].
Step 2	`Router(config-slb-policy)# url-map url-map-name`	Configure a list of URLs with a policy[2]. You must have previously created and configured the URL maps and cookie maps with the **ip slb map** command. See the "Configuring Maps" section on page 27.
Step 3	`Router(config-slb-policy)# cookie-map cookie-map-name`	Configure a list of cookies with a policy[2].
Step 4	`Router(config-slb-policy)# sticky-group group-id`	Associate this policy to a specific sticky group[2].

	Command	Purpose
Step 5	Router(config-slb-policy)# **client-group** *value* | *std-access-list-name*	Configure a client filter associated with a policy. Only standard IP access lists are used to define a client filter. Refer to the *Catalyst 6000 Family Software Configuration Guide* for information about configuring access lists.
Step 6	Router(config-slb-policy)# **serverfarm** *serverfarm-name*	Configure the server farm serving a particular load-balancing policy. Only one server farm can be configured per policy[2].
Step 7	Router(config-slb-policy)# **set ip dscp** *dscp-value*	Mark traffic with a *dscp-value* if packets matched with the load-balancing policy[2].

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu’s top level.

[2] The **no** form of this command restores the defaults.

This example shows how to configure load-balancing policies and associate them to virtual servers:

```
Router(config)# ip slb policy policy_sticky_ck
Router(config-slb-policy)# serverfarm pl_sticky
Router(config-slb-policy)# url-map map1
Router(config-slb-policy)# exit
Router(config)# ip slb vserver vs_sticky_ck
Router(config-slb-vserver)# slb-policy policy_sticky_ck
```

Configuring Maps

You configure maps to define multiple URLs and cookies into groups that can be associated with a policy when you configure the policy. (See the “Configuring Policies” section on page 26.)

To add a URL map, perform this task:

	Command	Purpose
Step 1	Router(config)# **ip slb map** *url-map-name* **url**	Configure multiple URLs into a URL map in the URL map submode. Regular expressions for URLs (for example *url1* and *url2*) are based on UNIX filename specifications[1, 2]. See Table 3 for more information.
Step 2	Router(config-slb-map-url) **match protocol http url** *url-path*	Match the URL map with the URL path[2].

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu’s top level.

[2] The **no** form of this command restores the defaults.

Table 3 UNIX File Name Specifications

Convention	Description
*	Zero or more characters.
?	Exactly one character.
\	Escaped character.
Bracketed range [0-9]	Matching any single character from the range.

Table 3 UNIX File Name Specifications (continued)

Convention	Description
A leading ^ in a range	Do not match any in the range. All other characters represent themselves.
.\a	Alert (ascii 7).
.\b	Backspace (ascii 8).
.\f	Form-feed (ascii 12).
.\n	Newline (ascii 10).
.\r	Carriage return (ascii 13).
.\t	Tab (ascii 9).
.\v	Vertical tab (ascii 11).
.\0	Null (ascii 0).
.\\	Backslash.
.\x##	Any ascii character as specified in two digit hex notation.

To add a cookie map, perform this task:

	Command	Purpose
Step 1	`Router(config)` **`ip slb map`** *`cookie-map-name`* **`cookie`**	Configure multiple cookies into a cookie map[1].
Step 2	`Router(config-slb-map-cookie)` **`match protocol http cookie`** *`cookie-name`* **`cookie-value`** *`cookie-value-expression`*	Configure multiple cookies[1].

[1] The **no** form of this command restores the defaults.

This example shows how to configure maps and associate them with a policy:

```
Router(config)# ip slb map url_1  url
Router(config-slb-map-url)# match protocol http url /url1
Router(config-slb-map-url)# exit
Router(config)# ip slb map url_2 url
Router(config-slb-map-url)# match protocol http url /url/url/url
Router(config-slb-map-url)# match protocol http url /reg/*long.*
Router(config-slb-map-url)# exit
Router(config)# ip slb serverfarm pl_url_url_1
Router(config-slb-sfarm)# real 10.8.0.26
Router(config-slb-real)# inservice
Router(config-slb-real)# exit
Router(config-slb-sfarm)# exit
Router(config)# ip slb policy policy_url_1
Router(config-slb-policy)# serverfarm pl_url_url_1
Router(config-slb-policy)# url-map url_1
Router(config-slb-policy)# exit
Router(config)# ip slb serverfarm pl_url_url_2
Router(config-slb-sfarm)# real 10.8.0.27
Router(config-slb-real)# inservice
Router(config-slb-real)# exit
Router(config-slb-sfarm)# exit
Router(config)# ip slb policy policy_url_2
Router(config-slb-policy)# serverfarm pl_url_url_2
Router(config-slb-policy)# url-map url_2
Router(config-slb-policy)# exit
Router(config)# ip slb vserver vs_url_url
Router(config-slb-vserver)# virtual 10.8.0.145 tcp 80
Router(config-slb-vserver)# slb-policy policy_url_1
Router(config-slb-vserver)# slb-policy policy_url_2
Router(config-slb-vserver)# inservice
Router(config-slb-vserver)# exit
```

Configuring Sticky Groups

Configuring a sticky group involves configuring the attributes of that group and associating it with a policy.

To configure sticky groups, perform this task:

Command	Purpose

`Router(config)#` **`ip slb sticky`** *`sticky-group-id`*
`[`**`netmask`** *`netmask`* `|` **`cookie`** *`name`* `|` **`ssl`**`]`
`[`**`timeout`** *`sticky-time`*`]`
	Ensure that connections from the same client matching the same policy use the same real server[1]. Sticky time specifies the period of time that the sticky information is kept. The default sticky time value is 0 minutes. You must change this timer to activate the sticky time.

[1] The **no** form of this command restores the defaults.

This example shows how to configure a sticky group and associate it with a policy:

```
Router(config)# ip slb serverfarm pl_stick
Router(config-slb-sfarm)# real 10.8.0.18
Router(config-slb-real)# inservice
Router(config-slb-sfarm)# real 10.8.0.19
Router(config-slb-real)# inservice
Router(config-slb-real)# exit
Router(config-slb-sfarm)# exit
Router(config)# ip slb sticky 1 cookie foo timeout 100
Router(config)# ip slb policy policy_sticky_ck
Router(config-slb-policy)# serverfarm pl_stick
Router(config-slb-policy)# sticky-group 1
Router(config-slb-policy)# exit
Router(config)# ip slb vserver vs_sticky_ck
Router(config-slb-vserver)# virtual 10.8.0.125 tcp 90
Router(config-slb-vserver)# slb-policy policy_sticky_ck
Router(config-slb-vserver)# inservice
Router(config-slb-vserver)# exit
```

Configuring Virtual Servers

Virtual servers represent groups of real servers and are associated with real server farms through policies. Configuring virtual servers requires setting the attributes of the virtual server specifying the default server farm (default policy) and eventually associating other server farms through a list of policies.

Note A single virtual server can be configured to operate at either Level 4 or Level 7. For a virtual server to operate at Level 4, specify the server farm (default policy) as part of the virtual server configuration (see Step 3 in the following task table). For a virtual server to operate at Level 7, add slb policies in the configuration of the virtual server (see Step 7 in the following task table).

Configure the virtual server in the virtual server configuration submode.

To configure virtual servers, perform this task:

	Command	Purpose
Step 1	Router(config)# **ip slb vserver** *virtserver-name*	Identify the virtual server and enter the virtual server configuration mode[1, 2].
Step 2	Router(config-slb-vserver)# **virtual** *ip-address* **tcp** *port*	Set the IP address for the virtual server optional port number or name and the connection coupling and type[2].
Step 3	Router(config-slb-vserver)# **serverfarm** *serverfarm-name*	**Note** Before you can associate a server farm with the virtual server, you must configure the server farm. See the "Configuring Server Farms" section on page 24. Associate the default server farm with the virtual server[2]. The default server farm (default policy) is used if a request does not match any slb policy or if there are no policies associated with the virtual server.
Step 4	Router(config-slb-vserver)# **sticky** *duration*	(Optional) Configure connections from the client to use the same real server[2]. The default is sticky on.
Step 5	Router(config-slb-vserver)# **client** *ip-address network-mask* [**exclude**]	(Optional) Restrict which clients are allowed to use the virtual server[2].
Step 6	Router(config-slb-vserver)# **slb-policy** *policy-name*	(Optional) Associate content switching policies with a virtual server[2]. Policies are processed in the order in which they are entered in the virtual server configuration. See the "Configuring Policies" section on page 26.
Step 7	Router(config-slb-vserver)# **inservice**	Enable the virtual server for use by the CSM[2].
Step 8	Router# **show ip slb vserver** [**details**]	Display information for virtual servers defined for Content Switching.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

This example shows how to configure a virtual server named barnett, associate it with the server farm named bosco, and configure a sticky connection with a duration of 50 seconds to sticky group 12:

```
Router(config)# ip slb vserver barnett
Router(config-slb-vserver)# virtual 12.3.23.4 tcp 34
Router(config-slb-vserver)# serverfarm bosco
Router(config-slb-vserver)# sticky 50 group 12
Router(config-slb-vserver)# end
Router# show ip slb vservers
```

Configuring TCP Parameters

Transmission Control Protocol (TCP) is a connection-oriented protocol that uses known protocol messages for activating and deactivating TCP sessions. In server load balancing, when adding or removing a connection from the connection database, the Finite State Machine correlates TCP signals such as SYN, SYN/ACK, FIN, and RST. When adding connections, these signals are used for detecting server failure and recovery and for determining the number of connections per server.

Note The CSM also supports User Datagram Protocol (UDP). Because UDP is not connection-oriented, protocol messages cannot be generically sniffed (without knowing details of the upper-layer protocol) to detect the beginning or end of a UDP message exchange. Detection of UDP connection termination is based on a configurable idle timer. Protocols requiring multiple simultaneous connections to the same real server (such as FTP) are supported. Internet Control Management Protocol (ICMP) messages (such as ping) destined for the virtual IP address are also handled.

To configure TCP parameters, perform this task:

	Command	Purpose
Step 1	`Router(config)#` **`ip slb vserver`** *`virtserver-name`*	Identify the virtual server and enter the virtual server configuration mode[1,2].
Step 2	`Router(config-slb-vserver)#` **`idle`** *`duration`*	Configure the amount of time (in seconds) connection information is maintained in the absence of packet activity for a connection[2].

[1] Enter the **exit** command to leave a mode or submode. To return to the `Router (config)>` top level of the menu, enter the **end** command.

[2] The **no** form of this command restores the defaults.

This example shows how to configure TCP parameters for virtual servers:

```
Router(config)# ip slb vserver barnett
Router(config-slb-vserver)# idle 10
```

Configuring Dynamic Feedback Protocol

Configuring the Dynamic Feedback Protocol (DFP) allows servers to provide feedback to the CSM to enhance load balancing. The DFP mechanism in server load balancing allows host agents (residing on the physical server) to dynamically report the change in status of the host systems providing a virtual service.

To configure DFP, perform this task:

	Command	Purpose
Step 1	Router(config)# **ip slb dfp** [**password** *password*]	Configure DFP manager, supply an optional password, and enter the DFP agent submode[1, 2].
Step 2	Router(config-slb-dfp)# **agent** *ip-address port* [*activity-timeout* | *retry-count* | *retry-interval*]	Configure time intervals between keepalive messages, number of consecutive connection attempts or invalid DFP reports, and the interval between connection attempts[2].
Step 3	Router# **show ip slb dfp** [**weights** | **agent** *ip-address port* | **detail**]	Display DFP manager and agent information.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

Note A DFP agent may be on any host machine. A DFP agent is independent of the IP addresses and port numbers of the real servers that are managed by the agent.

This example shows how to configure the dynamic feedback protocol without a password or agent:

```
Router(config)# ip slb dfp password password
Router(config-slb-dfp)# agent 123.234.34.55 5 6 10 20
Router(config-slb-dfp)# exit
```

Configuring Redirect Virtual Servers

The **redirect-vserver** command is a server farm submode command that allows you to configure virtual servers dedicated to real servers. This mapping provides connection persistence for clients to real servers across TCP sessions.

To configure redirect virtual servers, perform this task:

	Command	Purpose
Step 1	Router(config-slb-sfarm)# **redirect-vserver** *name*	Configure virtual servers dedicated to real servers and enter the redirect server submode[1, 2].
Step 2	Router(config-slb-redirect-v)# **webhost relocation** *relocation string*	Configure the relocation string to be sent in response to HTTP requests to the host name. Only the beginning of the relocation string can be specified. The remaining portion is taken from the original HTTP request[2].
Step 3	Router(config-redirect-v)# **webhost backup** *backup string*	Configure the relocation string sent in response to HTTP requests in the event that the redirect server is out of service. Only the beginning of the relocation string can be specified. The remaining portion is taken from the original HTTP request[2].
Step 4	Router(config-redirect-v)# **virtual** *v_ipaddress* **tcp** *port*	Configure the redirect virtual server IP address and port[2].

	Command	Purpose
Step 5	Router(config-redirect-v)# **idle** *duration*	Set the CSM connection idle timer for the redirect virtual server[2].
Step 6	Router(config-redirect-v)# **client** *ip-address network-mask* [**exclude**]	Configure the combination of the *ip-address* and *network-mask* used to restrict which clients are allowed to access the redirect virtual server[2].
Step 7	Router(config-redirect-v)# **inservice**	Enable the redirect virtual server and begin advertisements[2].
Step 8	Router# **show ip slb vserver redirect** [**detail**]	Show all redirect servers configured.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

This example shows how to configure redirect virtual servers to specify virtual servers to real servers in a server farm:

```
Router (config)# ip slb serverfarm FARM1
Router (config-slb-sfarm)# redirect-vserver REDIR_1
Router (config-slb-redirect-)# webhost relocation relo 301
Router (config-slb-redirect-)# virtual 172.1.2.30 tcp www
Router (config-slb-redirect-)# inservice
Router (config-slb-redirect-)# exit
Router (config-slb-sfarm)# redirect-vserver REDIR_2
Router (config-slb-redirect-)# webhost relocation relo 301
Router (config-slb-redirect-)# virtual 172.1.2.31 tcp www
Router (config-slb-redirect-)# inservice
Router (config-slb-redirect-)# exit
Router (config-slb-sfarm)# real 10.8.0.8
Router (config-slb-real)# redirect-vserver REDIR_1
Router (config-slb-real)# inservice
Router (config-slb-sfarm)# real 10.8.0.9
Router (config-slb-real)# redirect-vserver REDIR_2
Router (config-slb-real)# inservice
Router (config-slb-real)# end
Router# show ip slb serverfarm detail
```

Configuring Client NAT Pools

When you configure client Network Address Translation (NAT) pools, NAT converts the source IP address of the client requests into an IP address on the server-side VLAN. Use the NAT pool name in the server farm submode, using the **nat** command, to specify which connections need to be client NATed.

To configure client NAT pools, perform this task:

	Command	Purpose
Step 1	Router(config)# **ip slb natpool** *pool-name start-ip end-ip* **netmask** *mask*	Configure a content switching NAT. You must create at least one client address pool to use this command[1, 2].
Step 2	Router(config)# **ip slb serverfarm** *serverfarm-name*	Enter the server farm submode to apply the client NAT.

	Command	Purpose
Step 3	`Router(config-slb-serverfarm)# nat` *`clientpool-name`*	Associate the configured NAT pool with the server farm.
Step 4	`Router# show ip slb natpool [name` *`pool-name`*`] [detail]`	Display the NAT configuration.

1. Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.
2. The **no** form of this command restores the defaults.

This example shows how to configure client NAT pools:

```
Router(config)# ip slb natpool pool1 102.36.445.2 102.36.16.8 netmask 255.255.255.0
Router(config)# ip slb serverfarm farm1
Router(config-slb-sfarm)# nat client pool1
```

Configuring Server NAT

Server NAT allows you to support connections initiated by real servers and to provide a default configuration used for servers initiating connections that do not have matching entries in the server NAT configuration.

To configure NAT for the server, perform this task:

Command	Purpose
`Router(config)# ip slb static [drop | nat [ipaddress | virtual]]`	Configure the server-originated connections. Options include dropping them, NATing them with a given IP address, or NATing them with the virtual IP address that they are associated with[1, 2]. **Note** By default, the CSM allows server-originated connections without NAT.

1. Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.
2. The **no** form of this command restores the defaults.

Writing and Restoring Configurations

For information about saving and restoring configurations, refer to the *Catalyst 6000 Family IOS Software Configuration Guide*.

Configuration Examples

Caution All examples assume that the **ip slb mode csm** command has been entered as described in "Configuring the Content Switching Module" section on page 19.

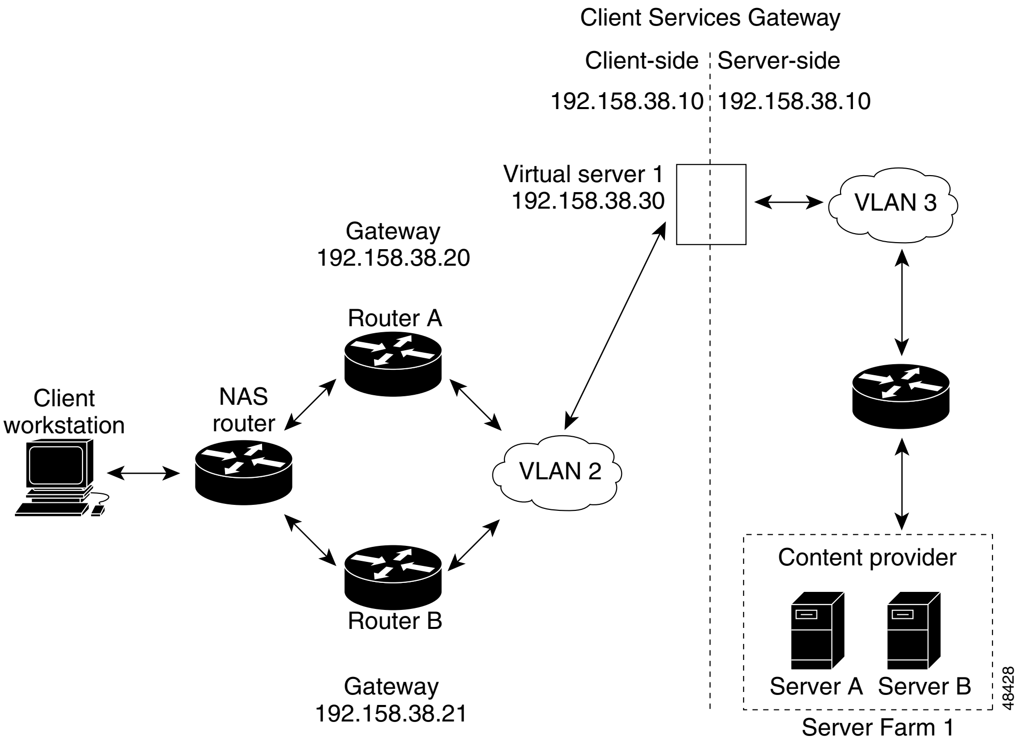
These examples show how to configure Content Switching in the following configurations:

- Single Subnet (Bridge) Mode Configuration, page 35
- Secure (Router) Mode Configuration, page 37
- Fault-Tolerant Configuration, page 38
- Configuring HSRP, page 43

Single Subnet (Bridge) Mode Configuration

In the single subnet (bridge) mode configuration, the client- and server-side VLANs are on the same subnets. Figure 9 shows how the single subnet (bridge) mode configuration is set up.

Figure 9 Single Subnet (Bridge) Mode Configuration



Note The addresses in Figure 9 refer to the steps in the following task table.

Note You configure single subnet (bridge) mode by assigning the same IP address to the CSM client and server VLANs.

To configure Content Switching for the single subnet (bridge) mode, perform this task:

	Command	Purpose
Step 1	`Router(config)# vlan database`	Enter the VLAN mode[1].
Step 2	`Router(vlan)# vlan 2`	Configure a client-side VLAN[2].
Step 3	`Router(vlan)# vlan 3`	Configure a server-side VLAN.
Step 4	`Router(vlan)# exit`	Exit to have the configuration take effect.
Step 5	`Router(config)# ip slb vlan 2 client`	Create the client-side VLAN 2 and enter the SLB VLAN mode[1].
Step 6	`Router(config-slb-vlan-client)# ip addr 192.158.38.10 255.255.255.0`	Assign the CSM IP address on VLAN 2.
Step 7	`Router(config-slb-vlan-client)# gateway 192.158.38.20`	Define the client-side VLAN gateway to Router A.
Step 8	`Router(config-slb-vlan-client)# gateway 192.158.38.21`	Define the client-side VLAN gateway to Router B.
Step 9	`Router(config-slb-vserver)# ip slb vlan 3 server`	Create the server-side VLAN 3 and enter the SLB VLAN mode.
Step 10	`Router(config-slb-vlan-client)# ip addr 192.158.38.10 255.255.255.0`	Assign the CSM IP address on VLAN 3.
Step 11	`Router(config-slb-vlan-client)# exit`	Leave the submode.
Step 12	`Router(config)# ip slb vserver VIP1`	Create a virtual server and enter the SLB vserver mode.
Step 13	`Router(config-slb-vserver)# virtual 192.158.38.30 tcp www`	Create a virtual IP address.
Step 14	`Router(config-slb-vserver)# serverfarm farm1`	Associate the virtual server with the server farm. **Note** This step assumes that the server farm has already been configured. See the "Configuring Server Farms" section on page 24.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

Note Set the server's default routes to Router A's gateway (192.158.38.20) or Router B's gateway (192.158.38.21).

Secure (Router) Mode Configuration

In secure (router) mode, the client- and server-side VLANs are on different subnets. Figure 10 shows how the secure (router) mode configuration is set up.

Figure 10 Secure (Router) Mode Configuration

Note The addresses in Figure 10 refer to the steps in the following task table.

To configure Content Switching in secure (router) mode, perform this task:

	Command	Purpose
Step 1	`Router(config)# vlan database`	Enter the VLAN mode[1].
Step 2	`Router(vlan)# vlan 2`	Configure a client-side VLAN[2].
Step 3	`Router(vlan)# vlan 3`	Configure a server-side VLAN.
Step 4	`Router(vlan)# exit`	Exit to have the configuration take effect.
Step 5	`Router(config)# ip slb vlan 2 client`	Create the client-side VLAN 2 and enter the SLB VLAN mode.
Step 6	`Router(config-slb-vlan-client)# ip addr 192.158.38.10 255.255.255.0`	Assign the CSM IP address on VLAN 2.
Step 7	`Router(config-slb-vlan-client)# gateway 192.158.38.20`	Define the client-side VLAN gateway to Router A.
Step 8	`Router(config-slb-vlan-client)# gateway 192.158.38.21`	Define the client-side VLAN gateway to Router B.

	Command	Purpose
Step 9	`Router(config)# ip slb vlan 3 server`	Create the server-side VLAN 3 and enter the SLB VLAN mode.
Step 10	`Router(config-slb-vlan-server)# ip addr 192.158.39.10 255.255.255.0`	Assign the CSM IP address on VLAN 3.
Step 11	`Router(config-slb-vlan-server)# exit`	Exit the submode.
Step 12	`Router(config)# ip slb vserver VIP1`	Create a virtual server and enter the SLB vserver mode.
Step 13	`Router(config-slb-vserver)# virtual 192.158.38.30 tcp www`	Create a virtual IP address.
Step 14	`Router(config-slb-vserver)# serverfarm farm1`	Associate the virtual server with the server farm. **Note** This step assumes that the server farm has already been configured. See the "Configuring Server Farms" section on page 24.

1. Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.
2. The **no** form of this command restores the defaults.

Note Set the server's default routes to the CSM's IP address (192.158.39.10).

Fault-Tolerant Configuration

This section describes a fault-tolerant configuration. In this configuration, two separate Catalyst 6000 family chassis each contain a CSM.

Note You can create a fault-tolerant configuration in either the secure (router) mode or nonsecure (bridge) mode.

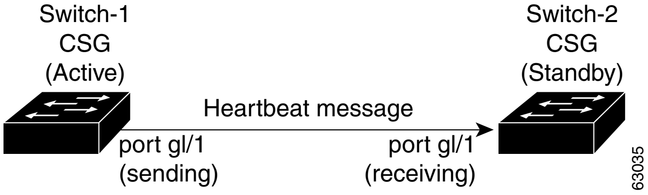
In the secure (router) mode, the client- and server-side VLANs provide the fault-tolerant (redundant) connection paths between the CSM and the routers on the client side and the servers on the server side. In a redundant configuration, two CSMs perform primary and secondary roles. Each CSM contains the same VLAN, IP, virtual server, server pool, and real server information. From the client-side and server-side networks, each CSM is configured identically. The network sees the fault-tolerant configuration as a single CSM.

Configuring fault-tolerance requires the following:

- Two CSMs that are installed in the Catalyst 6000 family chassis.
- Identically configured CSMs. One CSM is configured as the primary; the other is configured as the secondary.
- Each CSM connected to the same client- and server-side VLANs.
- Communication between the CSMs is provided by a shared private VLAN.
- A network that sees the redundant CSMs as a single entity.
- With Cisco IOS Release 12.1(8)E and later, you must configure Quality of Service (QoS) on each CSM in the fault-tolerant pair.

  Figure 11 shows the QoS configuration topology.

Figure 11 QoS Configuration Topology



Without this configuration, 802.1Q priority information is not preserved in packets traversing through to the switch. Heartbeat messages sent from the primary to the secondary CSM must contain this priority information so that they will be transmitted without delay. When an excessive delay occurs, an unnecessary takeover might occur.

You can overcome this limitation by configuring the sending port g1/1 to retain priority information upon transmission, and the receiving port g1/1 to trust the Class of Service (CoS) (Priority Bits) for the incoming packets.

Note In the following script, the **permit any any** command informs the switch to accept incoming packets with any MAC address from any MAC address.

To configure QoS for fault-tolerance, enter the following commands:

```
Router>
Router> enable
Router# configure terminal
Router(config)#
Router(config)# class-map match-any Venus
Router(config-cmap)# match access-group name Venus
Router(config-cmap)#
Router(config-cmap)# exit
Router(config)# policy-map Venus
Router(config-pmap)# class Venus
Router(config-pmap-c)# trust cos
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)#
Router(config)# mls qos
Router(config)#
Router(config)# mac access-list extended Venus
Router(config-ext-macl)# permit any any
Router(config-ext-macl)# exit
Router(config)# int GigabitEthernet 2/1
Router(config-if)# no ip address
Router(config-if)# service-policy input Venus
Router(config-if)# switchport
Router(config-if)# switchport access vlan 200
Router(config-if)# switchport trunk encapsulation dot1q
Router(config-if)# switchport trunk allowed vlan 1,200,1002-1005
Router(config-if)# switchport mode trunk
Router(config-if)# no cdp enable
Router(config-if)# end
Router# !
```

In the fault-tolerant configuration, the following rules apply:

Configuration Parameter	On Both Content Switching Modules	
	Same	Different
VLAN name	X	
VLAN address		X
Gateway[1] address	X	
Virtual server name	X	
Virtual IP address	X	
Alias IP addresses	X	
Redundancy group name	X	
Redundancy VLAN ID	X	

[1] Server default gateways must point to the alias IP address.

Because each CSM has a different IP address on the client- and server-side VLAN, the CSM can issue health monitor probes (see the "Configuring Probes for Health Monitoring" section on page 46 for health monitoring information) to the network and receive responses. Both the primary and secondary CSMs send probes while operational. In the event that the passive CSM assumes control, it knows the status of the servers because of the probe responses it has received.

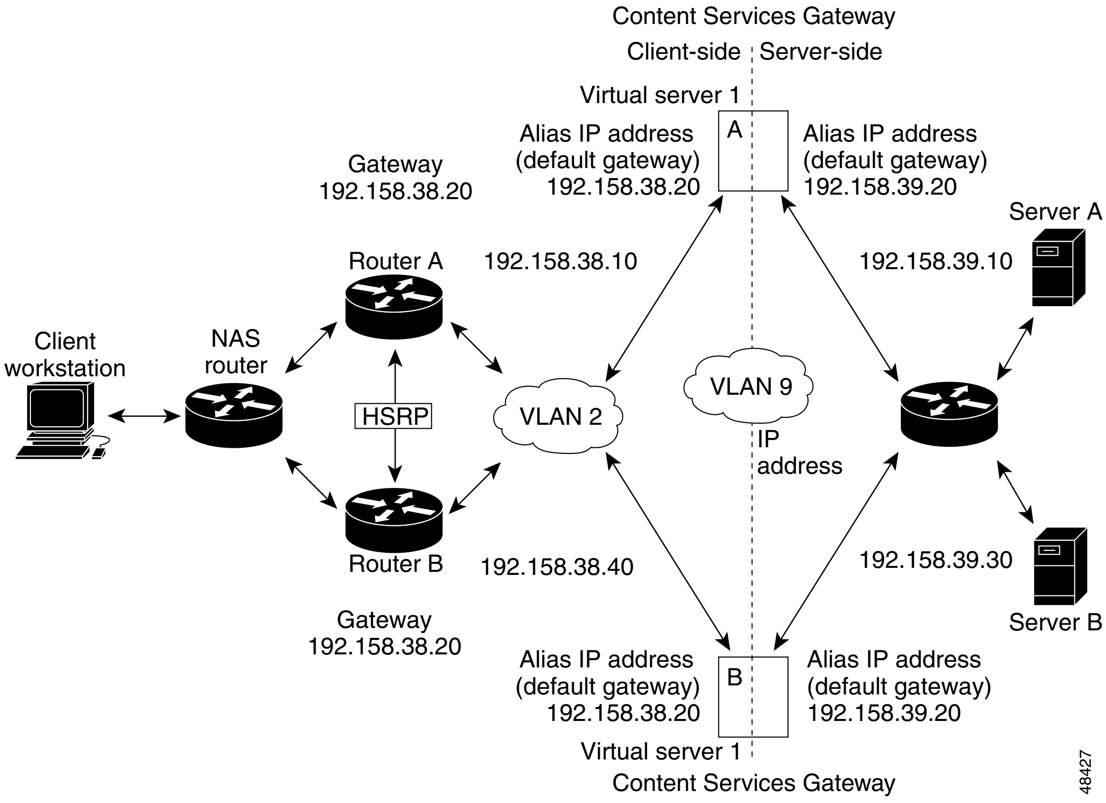
Enter the **backup** or **no backup** commands in the ip slb ft configuration mode to enable or disable sticky connection backup for the CSMs. Configuring fault-tolerant sticky connections requires the following:

- Specifying the server farm for which you are establishing fault-tolerant sticky connections using the **ip slb serverfarm** command.
- Enabling the fault-tolerant sticky connections while in the server farm submode.

If no router is present on the server-side VLAN, then each server's default route points to the aliased IP address.

Figure 12 shows how the secure (router) mode fault-tolerant configuration is set up.

Figure 12 Fault-Tolerant Configuration



Note The addresses in Figure 12 refer to the steps in the following two task tables.

To configure the primary (A) CSM for fault tolerance, perform this task (see Figure 12):

	Command	Purpose
Step 1	`Router(config)# ip slb vlan 2 client`	Create the client-side VLAN 2 and enter the SLB VLAN mode[1].
Step 2	`Router(config-slb-vlan-client)# ip addr 192.158.38.10 255.255.255.0`	Assign the Content Switching IP address on VLAN 1.
Step 3	`Router(config-slb-vlan-client)# gateway 192.158.38.20 255.255.255.0`	Define the client-side VLAN gateway to Router A and Router B HSRP address.
Step 4	`Router(config)# ip slb vserver vip1`	Create a virtual server and enter the SLB vserver mode.

	Command	Purpose
Step 5	Router(config-slb-vserver)# **virtual 192.158.38.30 tcp www**	Create a virtual IP address.
Step 6	Router(config)# **ip slb vlan 3 server**	Create the server-side VLAN 3 and enter the SLB VLAN mode.
Step 7	Router(config-slb-vserver)# **ip addr 192.158.39.10 255.255.255.0**	Assign the CSM IP address on VLAN 2.
Step 8	Router(config-slb-vserver)# **alias ip addr 192.158.39.20 255.255.255.0**	Assign the default route for VLAN 2.
Step 9	Router(config) **ip slb vlan 9 ft**	Define VLAN 9 as a fault-tolerant VLAN.
Step 10	Router(config)# **ip slb fault_tolerance group** *ft-group-number* **vlan 9**	Create the Content Switching primary and secondary (A/B) group VLAN 9.
Step 11	Router(config)# **vlan database**	Enter the VLAN mode[1].
Step 12	Router(vlan)# **vlan 2**	Configure a client-side VLAN2[2].
Step 13	Router(vlan)# **vlan 3**	Configure a server-side VLAN3.
Step 14	Router(vlan)# **vlan 9**	Configure a fault-tolerant VLAN9.
Step 15	Router(vlan)# **exit**	Enter the **exit** command to have the configuration take affect.

[1] xEnter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

[2] The **no** form of this command restores the defaults.

To configure the secondary (B) CSM for fault tolerance, perform this task (see Figure 12):

	Command	Purpose
Step 1	Router(config)# **ip slb vlan 2 client**	Create the client-side VLAN 2 and enter the SLB VLAN mode[1].
Step 2	Router(config-slb-vlan-client)# **ip addr 192.158.38.40 255.255.255.0**	Assign the Content Switching IP address on VLAN 2.
Step 3	Router(config) **ip slb vlan 9 ft**	Define VLAN 9 as a fault-tolerant VLAN.
Step 4	Router(config-slb-vlan-client)# **gateway 192.158.38.20**	Define the client-side VLAN gateway.
Step 5	Router(config)# **ip slb vserver vip1**	Create a virtual server and enter the SLB vserver mode.
Step 6	Router(config-slb-vserver)# **virtual 192.158.38.30 tcp www**	Create a virtual IP address.
Step 7	Router(config)# **ip slb vlan 3 server**	Create the server-side VLAN 3 and enter the SLB VLAN mode.
Step 8	Router(config-slb-vserver)# **ip addr 192.158.39.30 255.255.255.0**	Assign the CSM IP address on VLAN 3.
Step 9	Router(config-slb-vserver)# **alias 192.158.39.20 255.255.255.0**	Assign the default route for VLAN 2.
Step 10	Router(config)# **ip slb fault_tolerance group** *ft-group-number* **ab vlan 9**	Create the CSM primary and secondary (A/B) group VLAN 9.

[1] Enter the **exit** command to leave a mode or submode. Enter the **end** command to return to the menu's top level.

Configuring HSRP

This section provides an overview of a Hot Standby Router Protocol (HSRP) configuration (see Figure 13) and describes how to configure the CSMs with HSRP and CSM failover on the Catalyst 6000 family switches.

HSRP Configuration Overview

The figure shows two Catalyst 6000 switches, Switch 1 and Switch 2, are configured to route from a client-side network (10.100/16) to an internal CSM client network (10.6/16, VLAN 136) through an HSRP gateway (10.100.0.1).

- The client side network is assigned an HSRP Group ID = HSRP ID 2.
- The Internal CSM Client network is assigned an HSRP Group ID = HSRP ID 1.

Note HSRP group 1 must have tracking turned on so that it can track the client network ports on HSRP group 2. When HSRP group 1 detects any changes in the active state of those ports, it mirrors those changes so that both the HSRP primary (Switch 1) and HSRP secondary (Switch 2) share the same knowledge of the network.

In the example configuration, two CSMs (one in Switch 1 and one in Switch 2) are configured to forward traffic between a client -side and a server-side VLAN:

- Client VLAN 136

  Note The client VLAN is actually an internal CSM VLAN network; the actual client network is on the other side of the switch.

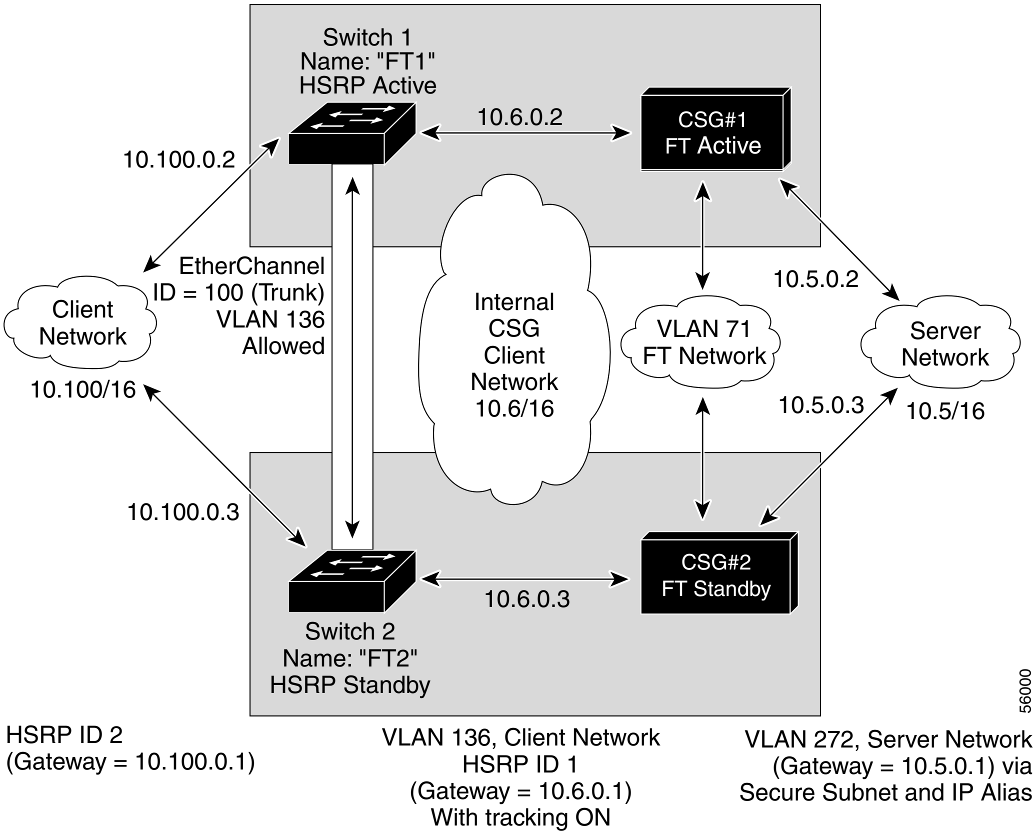
- Server VLAN 272

The actual servers on the server network (10.5/1) point at the CSM server network through an aliased gateway (10.5.0.1), allowing the servers to run a secure subnet.

In the example configuration, an EtherChannel is set up with trunking enabled, allowing traffic on the internal CSM Client network to travel between the two Catalyst 6000 family switches. The setup is shown in Figure 13.

Note EtherChannel protects against a severed link to the primary switch and a failure in a non-CSM component of the switch. EtherChannel also provides a path between an active CSM in one switch and another switch, allowing CSMs and switches to fail over independently, providing an extra level of fault tolerance.

Figure 13 HSRP Configuration



Creating the HSRP Gateway

This procedure describes how to create an HSRP gateway for the client-side network. The gateway is HSRP ID 2 for the client-side network.

Note In this example, HSRP is set on Fast Ethernet ports 3/6.

Step 1 Configure Switch 1—FT1 (HSRP primary) as follows:

```
interface FastEthernet3/6
ip address 10.100.0.2 255.255.0.0
standby 2 priority 110 preempt
standby 2 ip 10.100.0.1
```

Step 2 Configure Switch 2—FT2 (HSRP secondary) as follows:

```
interface FastEthernet3/6
ip address 10.100.0.3 255.255.0.0
standby 2 priority 100 preempt
standby 2 ip 10.100.0.1
```

Configuring CSM VLANs

This section describes how to create a fault-tolerant HSRP secure-mode configuration. To create a nonsecure-mode configuration, enter the commands described with these exceptions:

- Assign the same IP address to both the server-side and the client-side VLANs.
- Do not use the alias command to assign a default gateway for the server-side VLAN.

Step 1 Configure VLANs on HSRP FT1 as follows:

```
ip slb mode csm
ip slb vlan 136 client
ip address 10.6.0.245 255.255.0.0
gateway 10.6.0.1

ip slb vlan 272 server
ip address 10.5.0.2 255.255.0.0
alias 10.5.0.1 255.255.0.0

ip slb vlan 71 ft

ip slb ft group 88 vlan 71
priority 30
preempt

interface Vlan136
ip address 10.6.0.2 255.255.0.0
standby 1 priority 100 preempt
standby 1 ip 10.6.0.1
standby 1 track Fa3/6 10
```

Step 2 Configure VLANs on HSRP FT2 as follows:

```
ip slb mode csm
ip slb vlan 136 client
ip address 10.6.0.246 255.255.0.0
gateway 10.6.0.1

ip slb vlan 272 server
ip address 10.5.0.3 255.255.0.0
alias 10.5.0.1 255.255.0.0

ip slb vlan 71 ft

ip slb ft group 88 vlan 71
priority 20
preempt

interface Vlan136
ip address 10.6.0.3 255.255.0.0
standby 1 priority 100 preempt
standby 1 ip 10.6.0.1
standby 1 track Fa3/6 10
```

Note To allow tracking to work, preempt must be ON.

Step 3 Configure EtherChannel on both switches as follows:

```
interface Port-channel100
switchport
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 136
```

Note By default, all VLAN's are allowed on the port channel.

To prevent problems, remove the SERVER and FT CSM VLAN's, for example:

```
swtichport trunk remove vlan 71
switchport trunk remove vlan 272
```

Step 4 Add ports to the EtherChannel as follows:

```
interface FastEthernet3/25
switchport
channel-group 100 mode on
```

Configuring Probes for Health Monitoring

Configuring probes to the real servers allows you to determine if the real servers are operating correctly. A real server's health is categorized as follows:

- Active—the real server responds appropriately.
- Suspect—the real server is unreachable or returns an invalid response. The probes are retried.
- Failed—the real server fails to reply after a specified number of consecutive retries. You are notified and the CSM adjusts incoming connections accordingly. Probes continue to a failed server until the server becomes active again.

The CSM supports probes used to monitor real servers. Configuring a probe involves the following:

- Entering the probe submode
- Naming the probe
- Specifying the probe type

The CSM supports a variety of probe types that monitor real servers, including FTP, DNS, or HTTP.

Note By default, no probes are configured on the CSM.

To set up a probe, you must configure it by naming the probe and specifying the probe type while in probe submode.

After configuring a probe, you must associate it with a server farm for the probe to take effect. All servers in the server farm receive probes of the probe types that are associated with that server farm. You can associate one or more probe types with a server farm.

Note Do not specify a port number when you configure a probe. The probe inherits the port number from either the real server (if a port number was assigned when the real server was configured) or from the virtual server.

After you configure a probe, associate single or multiple probes with a server farm. All servers in the server farm receive probes of the probe types that are associated with that pool.

Note If you associate a probe of a particular type with a server farm containing real servers that are not running the corresponding service, the real servers send error messages when they receive a probe of that type.

To specify a probe type and name, perform this task:

Command	Purpose
`Router(config)# ip slb probe probe-name [http | icmp | telnet | tcp | ftp | smtp | dns]`	Specify a probe type and a name[1]. - *probe-name* is the name of the probe being configured; it has a character string of up to 15 characters. - **http** creates an HTTP probe with a default configuration. - **icmp** creates an ICMP probe with a default configuration. - **telnet** creates a Telnet probe with a default configuration. - **tcp** creates a TCP probe with a default configuration. - **ftp** creates an FTP probe with a default configuration. - **smtp** creates an SMTP probe with a default configuration. - **dns** creates a DNS probe with a default configuration.
`Router# show ip slb probe`	Display all probes and their configuration.

[1] The **no** form of this command removes the probe type from the configuration.

Note When you specify a probe name and type, it is initially configured with the default values. Enter the probe configuration commands to change the default configuration.

This example shows how to configure a probe:

```
Router(config)# ip slb probe probe1 tcp
Router(config-slb-probe-tcp)# interval 120
Router(config-slb-probe-tcp)# retries 3
Router(config-slb-probe-tcp)# failed 300
Router(config-slb-probe-tcp)# open 10
Router(config-slb-probe-tcp)# receive 10
```

Commands Available to all Probe Configurations

These commands are common to all probe types:

Command	Purpose

`Router(config-slb-probe)#` **`interval`** *`seconds`*	Set the interval between probes in seconds (from the end of the previous probe to the beginning of the next probe)[1].
	Range = 5–65535
	Default = 120 seconds

`Router(config-slb-probe)#` **`retries`** *`retry-count`*	Set the number of failed probes that are allowed before marking the server as failed[1].
	Range = 0–65535
	Default = 3

`Router(config-slb-probe)#` **`failed`** *`failed-interval`*	Set the time, in seconds, to wait before probing a failed server[1].
	Range = 5–65535
	Default = 300 seconds

`Router(config-slb-probe)#` **`open`** *`open-timeout`*	Set the maximum time to wait for a TCP connection. This command is not used for any non-TCP health checks (ICMP or DNS[1]).
	Range = 1–65535
	Default = 10 seconds

`Router(config-slb-probe)#` **`receive`** *`receive-timeout`*	Set the maximum time in seconds to wait for a reply from the real server[1].
	Range = 1–65535
	Default = 10 seconds

[1] The **no** form of this command restores the defaults.

HTTP Probe

An HTTP probe establishes an HTTP connection to a real server and then sends an HTTP request and verifies the response. The **ip slb probe** *probe-name* **http** command places the user in HTTP probe configuration submode.

To configure an HTTP probe, perform this task:

	Command	Purpose
Step 1	`Router(config)#` **`ip slb probe`** *`probe-name`* ***`http`***	Configure an HTTP probe and enter the HTTP probe submode[1].
Step 2	`Router(config-slb-probe-http)#` **`credentials`** *`username`* `[`*`password`*`]`	Configure basic authentication values for the HTTP SLB probe[1].

	Command	Purpose
Step 3	`Router(config-slb-probe-http)# expect status min-number [max-number]`	Configure a status code to expect from the HTTP probe. You can configure multiple status ranges by entering one **expect** command at a time[1]. *min-number*—If you do not specify a *max-number*, this number is taken as a single status code. If you specify a *max-number*, this number is taken as the minimum status code of a range. *max-number*—The maximum status code in a range. The default range is 0–999. (Any response from the server is considered valid.) **Note** If no maximum is specified, this command takes a single number (min-number). If you specify both a min-number and a max-number, it takes the range of numbers.
Step 4	`Router(config-slb-probe-http)# header field-name [field-value]`	Configure a header field for the HTTP probe. Multiple header fields may be specified[1].
Step 5	`Router(config-slb-probe-http)# request [method [get|head]] [url path]`	Configure the request method used by an HTTP probe[1]: • **get**—Directs the HTTP **get** request method directs the server to get this page • **head**—Directs the HTTP **head** request method directs the server to get only the header for this page • **url**—A character string of up to 1275 characters specifies the URL path; the default path is "/" **Note** The CSM supports only the **get** and **head** request methods; it does not support the **post** and other methods. The default method is **head**.

[1] The **no** form of this command restores the defaults.

ICMP Probe

An ICMP probe sends an ICMP echo (for example, ping) to the real server. The **ip slb probe icmp** command enters the ICMP probe configuration mode. All the common **ip slb probe** commands are supported except **open**, which is ignored.

	Command	Purpose
Step 1	`Router(config)# ip slb probe probe-name icmp`	Configure an ICMP probe and enter the ICMP probe submode[1].
Step 2	`Router(config-slb-probe-icmp)# [failed | interval | retries | receive]`	Configure the intervals to wait between probes of a failed server and between probes. Also, specify the time to make a TCP connection, to receive a reply from the server, and to limit the number of retries before considering the real server as failed.

[1] The **no** form of this command restores the defaults.

TCP Probe

A TCP probe establishes and removes connections. The **ip slb probe tcp** command enters the TCP probe configuration mode. All the common **ip slb probe** commands are supported.

	Command	Purpose
Step 1	`Router(config)#` **`ip slb probe`** *`probe-name`* **`tcp`**	Configure a TCP probe and enter the TCP probe submode[1].
Step 2	`Router(config-slb-probe-tcp)# [`**`expect`**` | `**`failed`**` | `**`interval`**` | `**`open`**` | `**`receive`**` | `**`retries`**`]`	Configure the intervals to wait between probes of a failed server and between probes. Also, specify the time to make a TCP connection, to receive a reply from the server, and to limit the number of retries before considering the real server as failed.

[1] The **no** form of this command restores the defaults.

FTP, SMTP, and Telnet Probe

An FTP, SMTP, or Telnet probe establishes a connection to the real server and verifies that a greeting from the application was received. The **ip slb probe** (**ftp, smtp,** or **telnet**) command enters the corresponding probe configuration mode. All the **ip slb probe** common options are supported. Multiple status ranges are supported, one command at a time.

To configure a status code to expect from the FTP, SMTP, or Telnet probe, perform this task:

	Command	Purpose
Step 1	`Router(config)#` **`ip slb probe`** *`probe-name`* `[`**`ftp`**` | `**`smtp`**` | `**`telnet`**`]`	Configure an FTP, SMTP, or Telnet probe and enter the FTP, SMTP, or Telnet probe submode[1].
Step 2	`Router(config-slb-probe-ftp)# [`**`expect status`** *`min-number`* `[`*`max-number`*`] | `**`failed`**` | `**`interval`**` | `**`retries`**` | `**`receive`**`]`	Configure the intervals to wait between probes of a failed server and between probes. Also, specify the time to make a TCP connection, to receive a reply from the server, and to limit the number of retries before considering the real server as failed.

[1] The **no** form of this command restores the defaults.

DNS Probe Submode

A DNS probe sends a domain name resolve request to the real server and verifies the returned IP address. The **ip slb probe dns** command places the user in DNS probe configuration submode. All the ip slb probe common options are supported except **open,** which is ignored.

To specify the domain name resolve request, perform this task:

	Command	Purpose
Step 1	`Router(config)# ip slb probe probe-name dns`	Configure an DNS probe and enter the tcp probe submode[1].
Step 2	`Router(config-slb-probe-dns)# [expect | failed | interval | retries | receive]`	Configure times to wait between probes to make a DNS connection, to receive a reply from the server, and to limit the number of retries before considering the real server as failed.

[1] The **no** form of this command restores the defaults.

Configuring Route Health Injection

These sections describe the route health injection (RHI):

- Understanding RHI, page 51
- Configuring RHI for Virtual Servers, page 53

Understanding RHI

These sections describe the RHI:

- RHI Overview, page 51
- Routing to VIP Addresses Without RHI, page 52
- Routing to VIP Addresses With RHI, page 52
- Understanding How the CSM Determines VIP Availability, page 53
- Understanding Propagation of VIP Availability Information, page 53

RHI Overview

RHI allows the CSM to advertise the availability of a VIP address throughout the network. Multiple CSM devices with identical VIP addresses and services can exist throughout the network. One CSM can override the load-balancing services over the other devices if the services are no longer available on the other devices, or one CSM can provide the services because it is logically closer to the client systems than other server load-balancing devices.

Note RHI is restricted to intranets because the CSM advertises the VIP address as a host-route and most routers do not propagate the host-route information to the Internet.

To enable RHI, configure the CSM to do the following:

- Probe real servers and identify available virtual servers and VIP addresses
- Advertise accurate VIP address availability information to the MSFC whenever a change occurs

Note On power-up with RHI enabled, the CSM sends a message to the MSFC as each VIP address becomes available.

The MSFC periodically propagates the VIP address availability information that RHI provides.

Note RHI is normally restricted to intranets because, for security reasons, most routers do not propagate host-route information to the Internet.

Routing to VIP Addresses Without RHI

Without RHI, traffic reaches the VIP address by following a route to the client VLAN to which the VIP address belongs. When the CSM powers on, the MSFC creates routes to client VLANs in its routing table and shares this route information with other routers. To reach the VIP, the client systems rely on the router to send the requests to the network subnet address where the individual VIP address lives.

If the subnet or segment is reachable but the virtual servers on the CSM at this location are not operating, the requests fail. Other CSM devices can be at different locations. However, the routers only send the requests based on the logical distance to the subnet.

Without RHI, traffic is sent to the VIP address without any verification that the VIP address is available. The real servers attached to the VIP might not be active.

Note By default, the CSM will not advertise the configured VIP addresses.

Routing to VIP Addresses With RHI

With RHI, the CSM sends advertisements to the MSFC when VIP addresses become available and withdraws advertisements for VIP addresses that are no longer available. The router looks in the routing table to find the path information it needs to send the request from the client to the VIP address. When the RHI feature is turned on, the advertised VIP address information is the most specific match. The request for the client is sent through the path where it reaches the CSM with active VIP services.

When multiple instances of a VIP address exist, a client router receives the information it needs (availability and hop count) for each instance of a VIP address, allowing it to determine the best available route to that VIP address. The router picks the path where the CSM is logically closer to the client system.

Note With RHI, you must also configure probes because the CSM determines if it can reach a given VIP address by probing all the real servers that serve its content. After determining if it can reach a VIP address, the CSM shares this availability information with the MSFC. The MSFC, in turn, propagates this VIP availability information to the rest of the intranet.

Understanding How the CSM Determines VIP Availability

For the CSM to determine if a VIP is available, you must configure a probe (HTTP, ICMP, Telnet, TCP, FTP, SMTP, or DNS) and associate it with a server farm. With probes configured, the CSM performs these checks:

- Probes all real servers on all server farms configured for probing
- Identifies server farms that are reachable (have at least one reachable real server)
- Identifies virtual servers that are reachable (have at least one reachable server farm)
- Identifies VIPs that are reachable (have at least one reachable virtual server)

Understanding Propagation of VIP Availability Information

With RHI, the CSM sends advertise messages to the MSFC containing the available VIP addresses. The MSFC adds an entry in its routing table for each VIP address it receives from the CSM. The routing protocol running on the MSFC sends routing table updates to other routers. When a VIP address becomes unavailable, its route is no longer advertised, the entry times out, and the routing protocol propagates the change.

Note For RHI to work on the CSM, the MSFC in the chassis in which the CSM resides must run Release 12.1.7(E) or later and must be configured as the client side router.

Configuring RHI for Virtual Servers

Step 1 Verify that you have configured VLANs (see the "Configuring VLANs" section on page 21).

Step 2 Associate the probe with a server farm (see the "Configuring Server Farms" section on page 24).

Step 3 Configure the CSM to probe real servers (see the "Configuring Probes for Health Monitoring" section on page 46).

Step 4 Enter the **advertise active** SLB virtual server command to enable RHI for each virtual server:

```
Router(config)# ip slb vserver virtual_server_name
Router(config-slb-vserver)# advertise active
```

This example shows how to enable RHI for the virtual server named vserver1.

```
Router(config)# ip slb vserver vserver1
Router(config-slb-vserver)# advertise active
```

Regulatory Standards Compliance

Catalyst 6000 family switching modules, when installed in a system, comply with the standards listed in Table 4.

Table 4 Regulatory Standards Compliance

Agency Approvals	Description
Compliance	CE[1] Marking
Safety	UL[2] 1950, CSA[3]-C22.2 No. 950, EN[4] 60950, IEC[5] 950, TS[6] 001, AS/NZS[7] 3260
EMC	FCC[8] Part 15 (CFR[9] 47) Class A, ICES[10]-003 Class A, EN55022 Class A, CISPR22 Class A, AS/NZS 3548 Class A, and VCCI Class A, EN55024, EN300 386, EH50082-1, EN55022 Class B, CISPR22 Class B, VCCI Class B, AS/NZ 3548 Class B

[1] CE = European Compliance

[2] UL = Underwriters Laboratory

[3] CSA = Canadian Standards Association

[4] EN = European Norm

[5] IEC = International Electrotechnical Commission

[6] TS = Technical Specification

[7] AS/NZS = Standards Australia/Standards New Zealand

[8] FCC = Federal Communications Commission

[9] CFR = Code of Federal Regulations

[10] ICES = Interference-Causing Equipment Standard

Translated Safety Warnings

Safety Information Referral Warning

Warning **Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.**

Waarschuwing **Lees de handleiding *Voorbereiding en veiligheid van de locatie Handleiding* voordat u het systeem installeert of gebruikt of voordat u onderhoud aan het systeem uitvoert. Deze handleiding bevat belangrijke beveiligingsvoorschriften waarvan u op de hoogte moet zijn voordat u met het systeem gaat werken.**

Varoitus **Ennen kuin asennat järjestelmän tai käytät tai huollat sitä, lue *Asennuspaikan valmistelu-jaturvaopas* -opasta. Tässä oppaassa on tärkeitä turvallisuustietoja, jotka tulisi tietää ennen järjestelmän käyttämistä.**

Attention Avant d'installer le système, de l'utiliser ou d'assurer son entretien, veuillez lire le *Guide de sécurité et de préparation du site*. Celui-ci présente des informations importantes relatives à la sécurité, dont vous devriez prendre connaissance.

Warnung Warnhinweis Bevor Sie das System installieren, in Betrieb setzen oder warten, lesen Sie die *Anleitung zur Standortvorbereitung und Sicherheitshinweise*. Dieses Handbuch enthält wichtige Informationen zur Sicherheit, mit denen Sie sich vor dem Verwenden des Systems vertraut machen sollten.

Avvertenza Prima di installare, mettere in funzione o effettuare interventi di manutenzione sul sistema, leggere le informazioni contenute nella documentazione sulla *Guida alla sicurezza*. Tale guida contiene importanti informazioni che è necessario acquisire prima di iniziare qualsiasi intervento sul sistema.

Advarsel Før du installerer, tar i bruk eller utfører vedlikehold på systemet, må du lese *Veiledning for stedsklargjøring og sikkerhet*. Denne håndboken inneholder viktig informasjon om sikkerhet som du bør være kjent med før du begynner å arbeide med systemet.

Aviso Antes de instalar, funcionar com, ou prestar assistência ao sistema, leia o *Guia de Preparação e Segurança do Local*. Este guia contém informações de segurança importantes que deve conhecer antes de trabalhar com o sistema.

¡Advertencia! Antes de instalar, manejar o arreglar el sistema, le aconsejamos que consulte la *Guía de prevención y preparación de una instalación*. Esta guía contiene importante información para su seguridad que debe saber antes de comenzar a trabajar con el sistema.

Varning! Innan du installerar, använder eller utför service på systemet ska du läsa *Förberedelser och säkerhet Handbok*. Denna handbok innehåller viktig säkerhetsinformation som du bör känna till innan du arbetar med systemet.

Wrist Strap Warning

Warning During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.

Waarschuwing Draag tijdens deze procedure aardingspolsbanden om te vermijden dat de kaart beschadigd wordt door elektrostatische ontlading. Raak het achterbord niet rechtstreeks aan met uw hand of met een metalen werktuig, omdat u anders een elektrische schok zou kunnen oplopen.

Varoitus Käytä tämän toimenpiteen aikana maadoitettuja rannesuojia estääksesi kortin vaurioitumisen sähköstaattisen purkauksen vuoksi. Älä kosketa taustalevyä suoraan kädelläsi tai metallisella työkalulla sähköiskuvaaran takia.

Attention **Lors de cette procédure, toujours porter des bracelets antistatiques pour éviter que des décharges électriques n'endommagent la carte. Pour éviter l'électrocution, ne pas toucher le fond de panier directement avec la main ni avec un outil métallique.**

Warnung **Zur Vermeidung einer Beschädigung der Karte durch elektrostatische Entladung während dieses Verfahrens ein Erdungsband am Handgelenk tragen. Bei Berührung der Rückwand mit der Hand oder einem metallenen Werkzeug besteht Elektroschockgefahr.**

Avvertenza **Durante questa procedura, indossare bracciali antistatici per evitare danni alla scheda causati da un'eventuale scarica elettrostatica. Non toccare direttamente il pannello delle connessioni, né con le mani né con un qualsiasi utensile metallico, perché esiste il pericolo di folgorazione.**

Advarsel **Bruk jordingsarmbånd under prosedyren for å unngå ESD-skader på kortet. Unngå direkte berøring av bakplanet med hånden eller metallverktøy, slik at di ikke får elektrisk støt.**

Aviso **Durante este procedimento e para evitar danos ESD causados à placa, use fitas de ligação à terra para os pulsos. Para evitar o risco de choque eléctrico, não toque directamente na parte posterior com a mão ou com qualquer ferramenta metálica.**

¡Advertencia! **Usartiras conectadas a tierra en las muñecas durante este procedimiento para evitar daños en la tarjeta causados por descargas electrostáticas. No tocar el plano posterior con las manos ni con ninguna herramienta metálica, ya que podría producir un choque eléctrico.**

Varning! **Använd jordade armbandsremmar under denna procedur för att förhindra elektrostatisk skada på kortet. Rör inte vid baksidan med handen eller metallverktyg då detta kan orsaka elektrisk stöt.**

Blank Faceplate Installation Requirement Warning

Warning **Blank faceplates (filler panels) serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards and faceplates are in place.**

Waarschuwing **Lege vlakplaten (vulpanelen) vervullen drie belangrijke functies: ze voorkomen blootstelling aan gevaarlijke voltages en elektrische stroom binnenin het chassis; ze beperken elektromagnetische storing hetgeen andere apparaten kan storen en ze leiden een stroom van koellucht door het chassis. Bedien het systeem niet tenzij alle kaarten en vlakplaten zich op hun plaats bevinden.**

Varoitus

Tyhjillä kansilaatoilla (peitelevyillä) on kolme tehtävää: ne suojaavat vaarallisilta asennuspohjan sisäisiltä jännitteiltä ja virroilta; suojaavat sähkömagneettiselta häiriöltä (EMI), joka voi haitata muiden laitteiden toimintaa; ja ohjaavat jäähdytysilmavirran asennuspohjan läpi. Laitetta ei saa käyttää, jos kaikki kortit ja peitelevyt eivät ole paikoillaan.

Attention

Les caches blancs remplissent trois fonctions importantes : ils évitent tout risque de choc électrique à l'intérieur du châssis, ils font barrage aux interférences électromagnétiques susceptibles d'altérer le fonctionnement des autres équipements et ils dirigent le flux d'air de refroidissement dans le châssis. Il est vivement recommandé de vérifier que tous les caches et plaques de protection sont en place avant d'utiliser le système.

Warnung

Unbeschriftete Aufspannplatten (Füllpaneelen) erfüllen drei wichtige Funktionen : sie schützen vor gefährlichen Spannungen und Elektrizität im Innern der Chassis; sie halten elektromagnetische Interferenzen (EMI) zurück, die andere Geräte stören könnten; und sie lenken die Kühlluft durch das Chassis. Nehmen Sie das System nur in Betrieb, wenn alle Karten und Aufspannplatten an vorgesehener Stelle odnungsgemäß installiert sind.

Avvertenza

Le piastre di protezione (panelli di riempimento) hanno tre funzioni molto importanti:Impediscono di esporvi ai voltaggi e le tensioni elettriche pericolose del chassis; trattengono le interferenze elettromagnetiche (EMI) che possono scombussolare altri apparati; e avviano il flusso d'aria di raffreddamento attraverso il chassis. Non operate il sistema se le schede e i pannelli non sono in posizione.

Advarsel

Blanke ytterplater (deksler) har tre viktige funksjoner: De forhindrer utsettelse for farlig spenning og strøm inni kabinettet; de inneholder elektromagnetisk forstyrrelse (EMI) som kan avbryte annet utstyr, og de dirigerer luftavkjølingsstrømmen gjennom kabinettet. Betjen ikke systemet med mindre alle kort og ytterplater sitter på plass.

Aviso

As placas em bruto (painéis de enchimento) desempenham três funções importantes: evitam a exposição a voltagens e correntes perigosas no interior do chassi; protegem de interferências electromagnéticas (IEM) passíveis de afectar outro equipamento; e orientam o fluxo do ar de refrigeração através do chassi. Não pôr o sistema a funcionar sem que todos os cartões e placas estejam no devido lugar.

¡Advertencia!

Los platos en blanco (paneles de relleno) ofrecen tres funciones importantes: previenen la exposición a voltajes peligrosos y corrientes dentro del chasis; contienen interferencias electromagnéticas (EMI) que pueden interrumpir otros equipos; y dirigen el flujo de aire refrigerante a través del chasis. No opere el sistema a menos que todas las tarjetas y platos estén en su lugar.

Varning!

Tomma planskivor (fyllnadspaneler) fyller tre viktiga funktioner: de förhindrar utsättning för farliga spänningar och elströmmar inuti chassit; de förhindrar elektromagnetisk störning (EMI) som skulle kunna rubba annan utrustning; samt de riktar flödet av kylluft genom chassit. Använd inte systemet om inte alla kort och planskivor finns på plats.

Qualified Personnel Warning

Warning **Only trained and qualified personnel should be allowed to install or replace this equipment.**

Waarschuwing **Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.**

Varoitus **Ainoastaan koulutettu ja pätevä henkilökunta saa asentaa tai vaihtaa tämän laitteen.**

Avertissement **Tout installation ou remplacement de l'appareil doit être réalisé par du personnel qualifié et compétent.**

Achtung **Gerät nur von geschultem, qualifiziertem Personal installieren oder auswechseln lassen.**

Avvertenza **Solo personale addestrato e qualificato deve essere autorizzato ad installare o sostituire questo apparecchio.**

Advarsel **Kun kvalifisert personell med riktig opplæring bør montere eller bytte ut dette utstyret.**

Aviso **Este equipamento deverá ser instalado ou substituído apenas por pessoal devidamente treinado e qualificado.**

¡Atención! **Estos equipos deben ser instalados y reemplazados exclusivamente por personal técnico adecuadamente preparado y capacitado.**

Varning **Denna utrustning ska endast installeras och bytas ut av utbildad och kvalificerad personal.**

Related Documentation

For more detailed installation and configuration information, refer to the following publications:

- *Site Preparation and Safety Guide*
- *Catalyst 6000 Family Installation Guide*
- *Catalyst 6000 Family Quick Software Configuration Guide*
- *Catalyst 6000 Family Module Installation Guide*
- *Catalyst 6000 Family IOS Software Configuration Guide*
- *Catalyst 6000 Family IOS Command Reference*
- *ATM Software Configuration and Command Reference—Catalyst 5000 Family and Catalyst 6000 Family Switches*
- *Catalyst 6000 Family IOS System Message Guide*
- For information about MIBs, refer to:

  http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml
- Release Notes for Catalyst 6000 Family IOS Software

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following sites:

- http://www.cisco.com
- http://www-china.cisco.com
- http://www-europe.cisco.com

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or as an annual subscription.

Ordering Documentation

Cisco documentation is available in the following ways:

- Registered Cisco Direct Customers can order Cisco Product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/cgi-bin/order/order_root.pl
- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

  http://www.cisco.com/go/subscription
- Nonregistered CCO users can order documentation through a local account representative by calling Cisco corporate headquarters (California, USA) at 408 526-7208 or, in North America, by calling 800 553-NETS(6387).

Documentation Feedback

If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

You can e-mail your comments to bug-doc@cisco.com.

To submit your comments by mail, for your convenience many documents contain a response card behind the front cover. Otherwise, you can mail your comments to the following address:

Cisco Systems, Inc.
Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

Cisco.com

Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information and resources at anytime, from anywhere in the world. This highly integrated Internet application is a powerful, easy-to-use tool for doing business with Cisco.

Cisco.com provides a broad range of features and services to help customers and partners streamline business processes and improve productivity. Through Cisco.com, you can find information about Cisco and our networking solutions, services, and programs. In addition, you can resolve technical issues with online technical support, download and test software packages, and order Cisco learning materials and merchandise. Valuable online skill assessment, training, and certification programs are also available.

Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1(P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

This document is to be used in conjunction with the documents listed in the "Related Documentation" section.